AMPEX

CP-100 Portable Instrumentation Recorder/Reproducer

Operations and Maintenance Manual

CHANGE NOTICE

This change is to be collated into Manual Number 68625-041 , dated DEC. 1963.

Superseded pages are to be destroyed.

AMPEX

68625-042

CP-100 Portable Recorder/Reproducer

Operation and Maintenance Manual

ISSUED: DECEMBER 1963
CHANGED: 15 AUGUST 1964

AMPEX

Note: Asterisk denotes pages affected by latest change.

LIST OF EFFECTIVE PAGES

This manual consists of 338 pages, comprised as follows:

Page	Issue Date
*Title	August 1964
*A thru B	August 1964
i thru iv (deleted)	April 1964
v thru vii	Original
viii	Blank
*ix	August 1964
x	Original
*xi thru xiii	August 1964
xiv thru xvi	Original
*xvii thru xviii	August 1964
xix	Original
*xx	August 1964
xxi thru xxii	Original
*xxiii	August 1964
xxiv	Blank
xxv	Original
xxvi	Blank
1-1 thru 1-2	Original
*1-3	August 1964
1-4 thru 1-10	Original
*1-11	August 1964
1-12 thru 1-13	Original
*1-14 thru 1-19	August 1964
1-20	Original
2-1 thru 2-8	Original
3-1 thru 3-9	Original
3-10	Blank
4-1 thru 4-7	Original
*4-8	August 1964
4-9 thru 4-17	Original
*4-18 thru 4-23H	August 1964
4-24 thru 4-29	Original
*4-30 thru 4-33	August 1964
4-34 thru 35	Original
*4-36 thru 4-37	August 1964
4-38 thru 4-39	Original
*4-40	August 1964
5-1 thru 5-21	Original
*5-22 thru 5-27	August 1964
5-28 thru 5-33	Original
*5-34 thru 5-36A	August 1964
*5-36B	Blank
*5-37	August 1964
5-38 thru 5-54	Original
*5-55 thru 5-56A	August 1964
*5-56B	Blank
5-57 thru 5-58	Original
6-1 thru 6-19	Original
*6-20	August 1964
6-21 thru 6-46	Original
*6-47	August 1964
6-48 thru 6-53	Original
6-54	Blank
6-55	Original
6-56	Blank
*6-57	August 1964
*6-58	Blank
6-59	Original
6-60	Blank
6-61	Original
6-62	Blank
*7-1	August 1964
7-2	Blank
7-3	Original
7-4	Blank
*46000E (2 of 2)	August 1964
46250F (2 of 2)	Original
46260Q (1 of 1)	Original
*46280C (3 of 3)	August 1964
46290E (2 of 2)	Original
46300B (1 of 1)	Original
46330C (3 of 3)	Original
46360A (1 of 1)	Original
*46364J (2 of 2)	August 1964
46365M/ 45661N (5 of 5)	Original
46370B (3 of 3)	Original
*46372N (1 of 1)	August 1964
46380B (3 of 3)	Original
46390G (1 of 1)	Original
*46400E (deleted)	August 1964
46410C (2 of 2)	Original
46420A (2 of 2)	Original
46730E (2 of 2)	Original

Issue -042

LIST OF EFFECTIVE PAGES

Page	Issue Date
48630B (1 of 1)	Original
*48641D (1 of 1)	August 1964
125622A (1 of 1)	Original
*1810217B (2 of 2)	August 1964
*1810251A (2 of 2)	August 1964
*8-1	August 1964
8-2	Blank
Fig 8-1 thru 8-9	Original
*Fig 8-10 thru 8-12	August 1964
Fig 8-13 thru 8-17	Original
*Fig 8-18	August 1964
SUPPLEMENT	
SA-1 thru SA-6	December 1963
126021 (1 of 1)	December 1963
126029 (1 of 1)	December 1963
126429 (1 of 1)	December 1963

SAFETY SUMMARY

The following is a summary of warnings and cautions which are to be observed to protect operating and service personnel, and to prevent damage to the equipment, its assemblies and parts.

WARNINGS

Section Reference	
2.10	TO PREVENT DAMAGE TO EQUIPMENT AND INJURY TO PERSONNEL, INSTALLATION KIT, PART NO. 125021-020 MUST BE USED IF THE CP-100 RECORDER/REPRODUCER SYSTEM IS RACK-MOUNTED.
6.10	UNLESS OTHERWISE SPECIFIED, ALL POWER MUST BE REMOVED FROM THE TRANSPORT WHILE TESTS AND ADJUSTMENTS ARE PERFORMED.
6.62	UNLESS OTHERWISE SPECIFIED, ALL POWER MUST BE REMOVED FROM THE TRANSPORT DURING DISASSEMBLY.
6.118	UNLESS OTHERWISE SPECIFIED, ALL POWER MUST BE REMOVED FROM THE TRANSPORT DURING ADJUSTMENTS.

CAUTIONS

2.23	IF THE BLOWERS ARE DISCONNECTED WHEN THE SYSTEM IS OPERATING FROM A 28 VDC OR 400 CPS POWER SOURCE, THE BLOWER-INVERTER CIRCUIT MUST BE DISCONNECTED. THIS IS DONE BY REMOVING THE JUMPER BETWEEN PINS M AND N OF P211 (FREQUENCY SELECT PLUG ON POWER CONTROL). FAILURE TO REMOVE THIS JUMPER MAY RESULT IN DAMAGE TO THE BLOWER INVERTER TRANSFORMER.
3.7	DO NOT CHANGE THE POSITION OF THE SPEED SELECTOR SWITCH WHILE POWER IS APPLIED TO THE TAPE TRANSPORT.
3.11	PERMANENT MAGNETIZATION OF THE HEADS OR TAPE GUIDE ASSEMBLIES CAN CAUSE DETERIORATION OF THE RECORDED SIGNAL OR REDUCTION OF THE SIGNAL-TO-NOISE RATIO. THE FOLLOWING PRECAUTIONS ARE TO

CAUTIONS (Cont'd.)

Section Reference	
	BE TAKEN TO AVOID PERMANENT MAGNETIZATION: a) DO NOT CONNECT OR DISCONNECT SIGNAL INPUT OR RECORD HEAD LEADS WHILE RECORDING. b) DO NOT TEST CONTINUITY OF THE HEADS WITH AN OHMMETER OR ANY SIMILAR TESTER. c) DO NOT ALLOW MAGNETIZED OBJECTS TO TOUCH ANY PART OF THE TAPE TRANSPORT.
4.39	REMOVE THE PREAMPLIFIERS TO PREVENT DAMAGING THEM.
4.41	REMOVE PREAMPLIFIERS TO PREVENT DAMAGE TO THEIR OUTPUT TRANSISTORS.
6.37	IF THE TIPS OF THE DEMAGNETIZER ARE NOT COVERED WITH A MATERIAL TO PROTECT THE HEADS, COVER THESE TIPS WITH A LENGTH OF VINYL ELECTRICAL TAPE.
6.70	DURING DISASSEMBLY, MAKE SURE THAT THE SET-SCREWS SEAT AGAINST THE FLATS ON THE SHAFT AND NOT THE SHAFT.
6.71	DO NOT DISASSEMBLE THE DRIVE MOTOR PULLEY BEYOND THIS POINT.
6.75	WHEN LIFTING OFF THE SUPPLY GUIDE, MAKE SURE THAT ANY SHIMS AND THE TWO WAVY WASHERS UNDERNEATH ARE ALSO REMOVED AND KEPT WITH THE COMPLETE SUB-ASSEMBLY (SEE FIGURE 6-7).
6.75	WHEN LIFTING OFF THE TAKE-UP GUIDE, MAKE SURE THAT ANY SHIMS UNDERNEATH ARE ALSO REMOVED AND KEPT WITH THE COMPLETE SUB-ASSEMBLY (SEE FIGURE 6-7).
6.76, 6.89	UNNECESSARY REMOVAL OF THESE BEARINGS MAY RESULT IN DAMAGE TO THE BEARINGS.
6.77	DO NOT DISASSEMBLE THE ACTUATOR ARM ASSEMBLY BEYOND THIS POINT.

CAUTIONS (Cont'd.)

Section Reference	
6.85	DO NOT DISASSEMBLE THE TURNAROUND IDLER BEYOND THIS POINT, AFTER REMOVAL OF THE EXCITER LAMPS.
6.87	AVOID BENDING THE CHASSIS WIRING UNNECESSARILY AS THIS MAY BREAK INNER CONDUCTORS IN THE LEADS.
6.104	DO NOT ATTEMPT TO REMOVE THE COLLAR FROM THE MOTOR SHAFT. IT IS GROUND IN PLACE.
6.120, 6.121	DO NOT STRAIGHTEN OUT BAND OTHERWISE THE LINING MATERIAL WILL SEPARATE FROM BAND.

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

CHAPTER EIGHT

SUPPLEMENT A

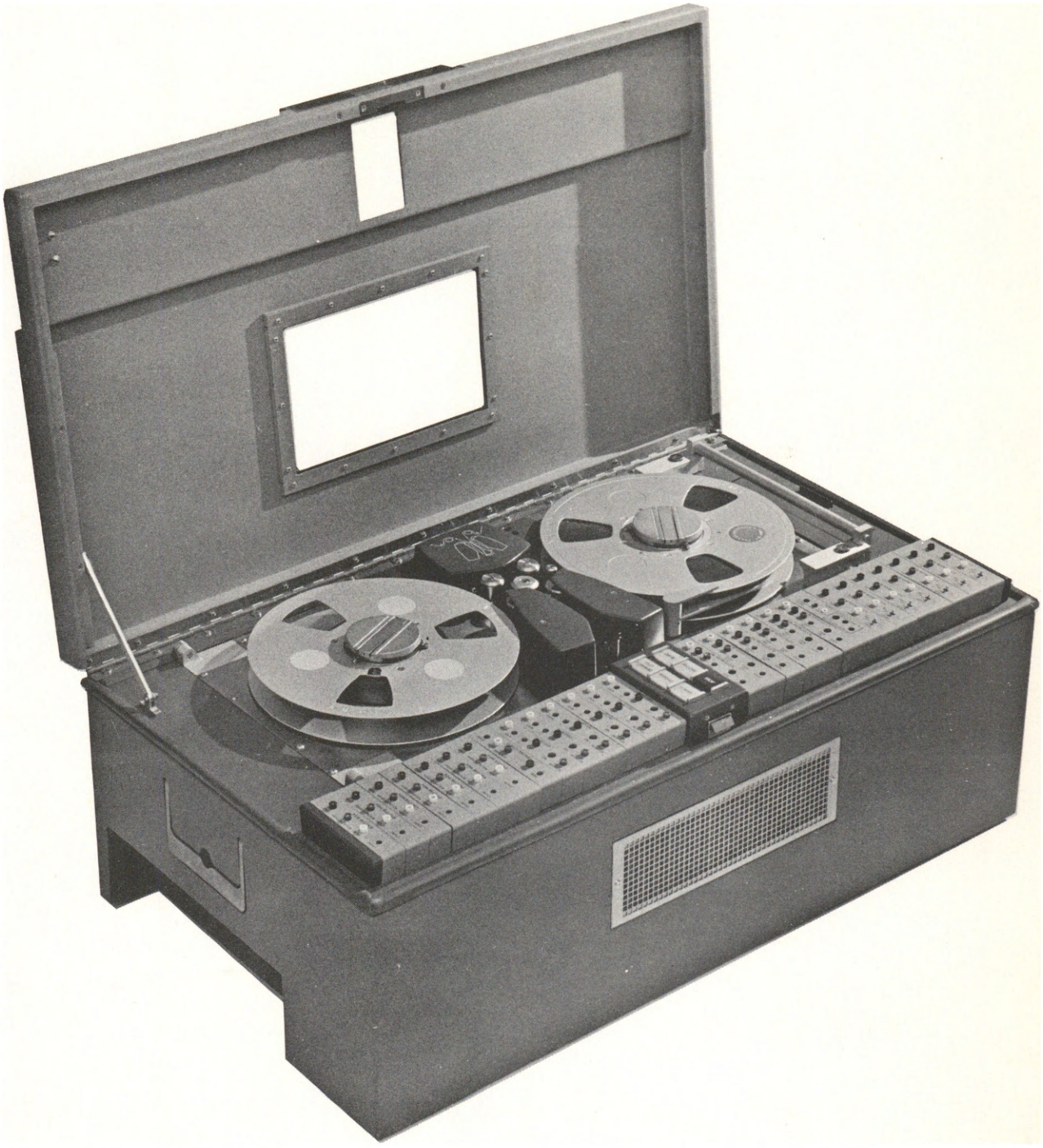
LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Cont'd.)

LIST OF ILLUSTRATIONS (Cont'd.)

LIST OF ILLUSTRATIONS (Cont'd.)

LIST OF TABLES



8298-17

CP-100 Recorder/Reproducer

CHAPTER ONE

DESCRIPTION AND SPECIFICATIONS

1.1 GENERAL DESCRIPTION

1.2 The Ampex CP-100 Recorder/Reproducer is a fully transistorized compact wideband magnetic tape recorder/reproducer. Comprising an accurate Tape Transport, with power supplies and printed circuit modular electronics, the equipment is capable of recording and reproducing data using the Direct, Frequency Modulation (FM), or Pulse Duration Modulation (PDM) techniques. The Tape Transport, power supplies, two printed circuit card compartments, (card rack) and a control unit, are mounted in a specially designed cabinet. The major supporting structure of the CP-100 is a rigid aluminum frame, which bears all mounting stresses. The Tape Transport, its cover and all electronics sub-assemblies are attached to the frame so that the entire system may be removed from the carrying case and mounted in a standard equipment rack. A recessed panel is provided at the bottom rear of the frame for external connections, and a recessed test panel is located just above the Tape Transport.

1.3 The Tape Transport is hinged at the bottom of the frame, and swings out to provide access to components behind the transport and inside the frame. System operating controls are mounted on the frame near the right hand center of the transport between the card racks for the plug-in record and reproduce amplifiers.

1.4 DETAILED DESCRIPTION

1.5 CASE AND COVER. The aluminum case, equipped with flush-type carrying handles, provides dust protection, and contains an integral filtered air cooling system. The case assembly is entirely independent of the rest of the system, and bears no mounting forces. The cover door hinged to the frame provides dust protection for the tape handling system. The pushbutton controls may be operated and tape motion observed while the cover door is closed.

1.6 TAPE TRANSPORT. Two basic versions of the Tape Transport are available, for use with 1/2 inch or 1 inch wide tape (conversion from one to the other may be made by

means of field modifications, information for which can be obtained by consulting the AMPEX Service Engineering Department). Reels with NARTB hubs, up to 10-1/2 inches in diameter can be accommodated on the Tape Transport. Figures 1-1 and 1-2 show the front and rear views respectively.

1.7 The capstan is driven by a two-speed motor through a belt and pulley arrangement. This permits three ranges, each of two speeds, to be obtained in the following manner: 1-7/8 and 3-3/4, 7-1/2 and 15, 30 and 60 inches per second (ips). The speeds are in the ratio of 1:2:4:8:16:32.

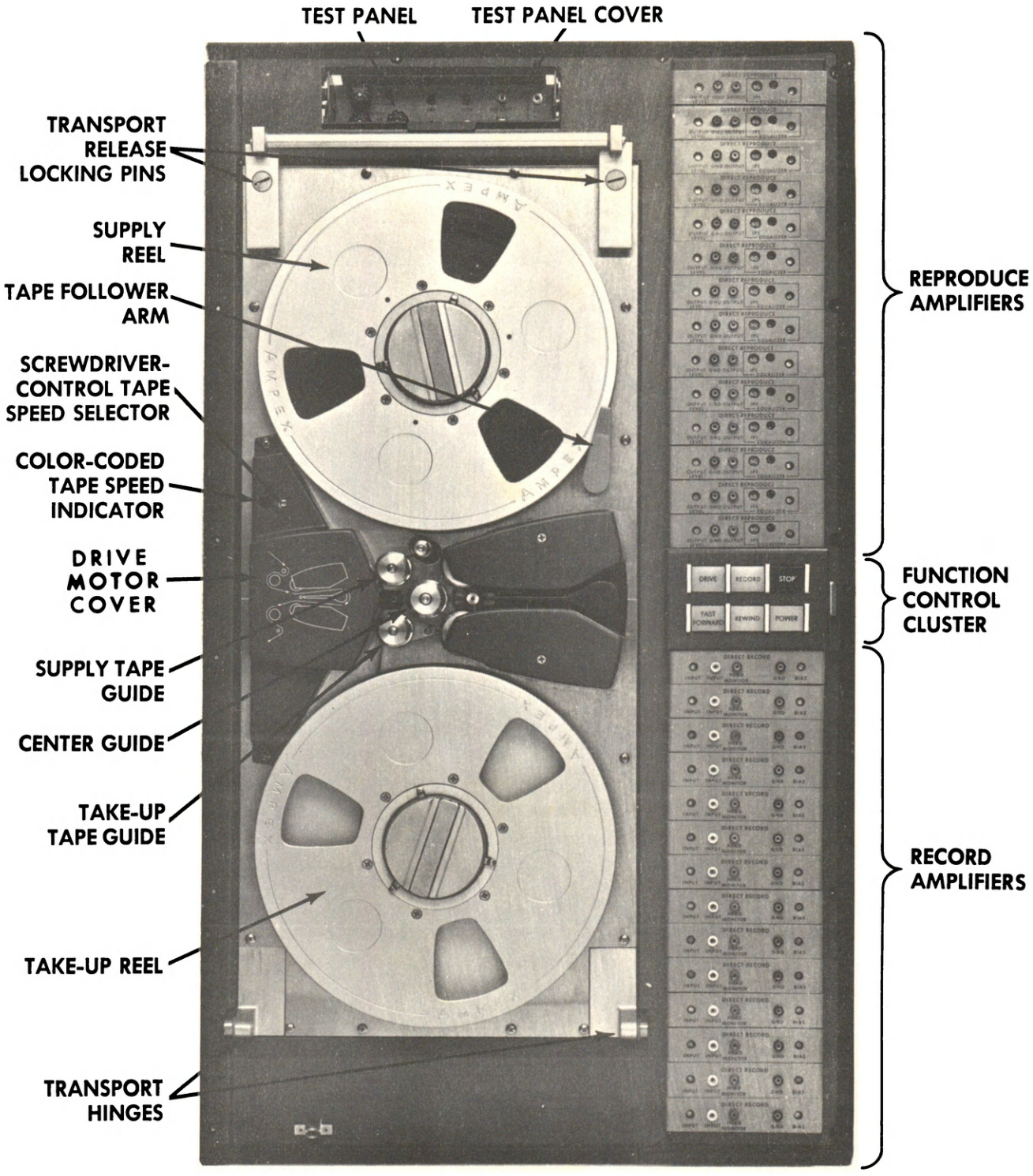
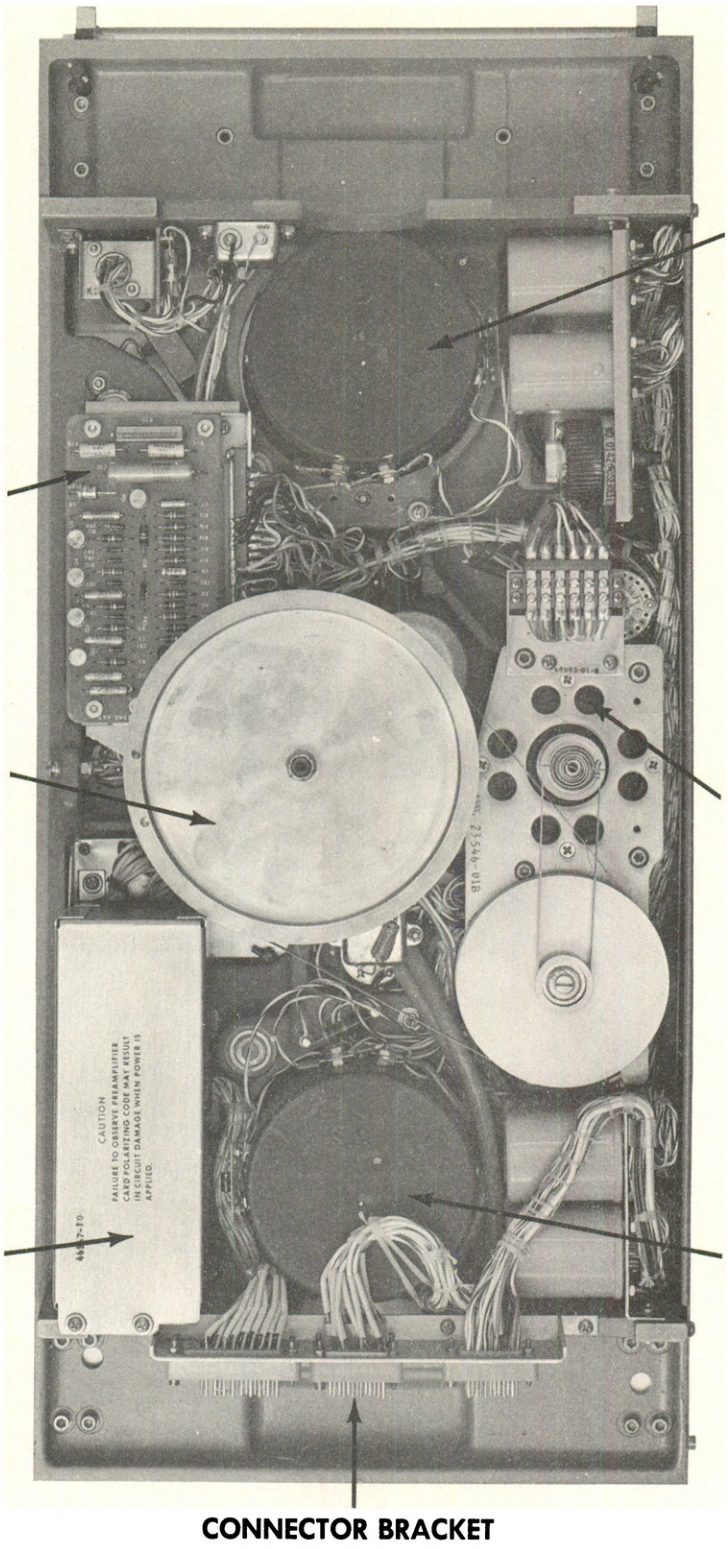
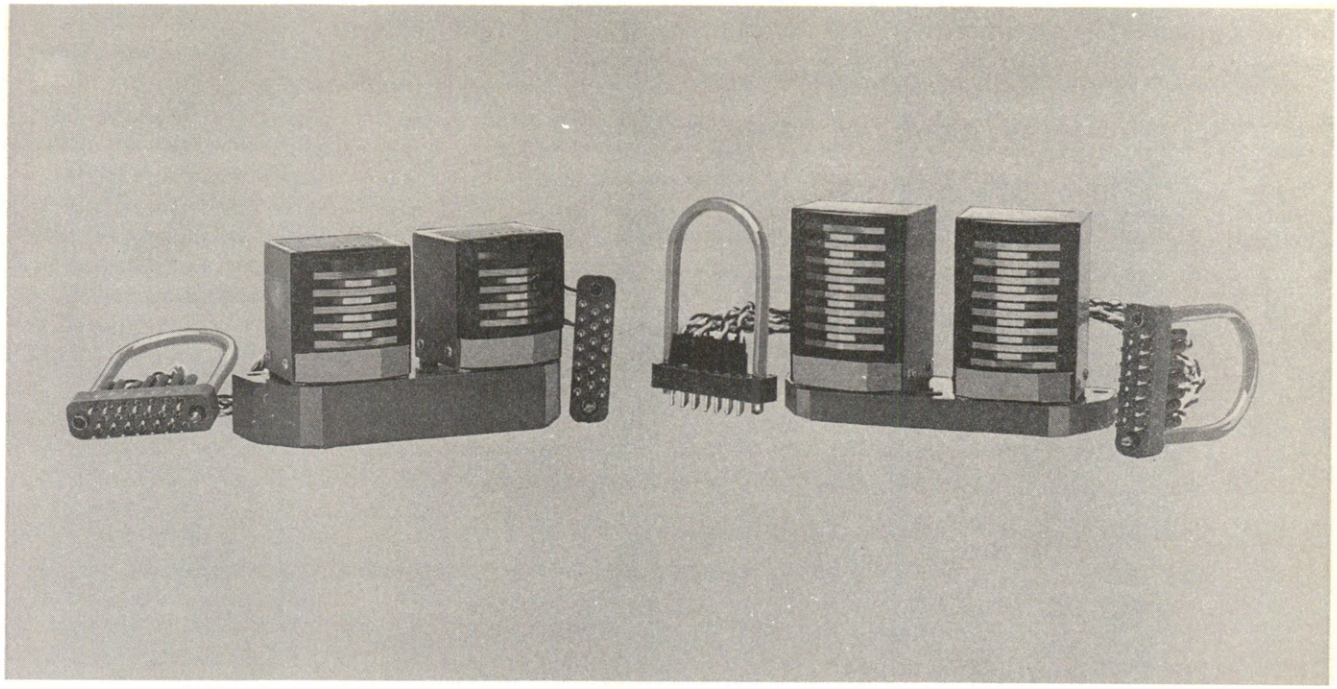


Figure 1-1. Front View of Tape Transport 8298-1



8298-4

Figure 1-2. Rear View of Tape Transport



7347-25

Figure 1-3. Typical Analog Head Assemblies, 7 and 14 Tracks

1.8 HEAD ASSEMBLIES. Head Assemblies are available for both recording and reproducing (figure 1-3). Analog Head Assemblies are available in 7-track and 14-track staggered head stack configurations. Head Assemblies are available in both Ampex Standard and IRIG track configurations.

1.9 The Analog Head Assemblies are compatible with AMPEX Series 300, FR-100, FR-600, FR-1100, FL-100, FL-200, FL-300, and AR-200. Other head assemblies are available on special order.

1.10 SPEED SENSING. A speed sensing circuit delays the closing of the pinch roller until the tape has reached the correct speed for recording or reproducing, in the upper three speeds. This circuit is mounted on a plug-in card on the underside of the Tape Transport (see figure 1-2).

1.11 CONTROLS. Local: The Tape Transport is controlled locally by six backlighted pushbuttons which provide POWER, DRIVE, RECORD, FAST FORWARD, REWIND and STOP functions (see figure 1-1). A TEST-OPERATE switch provides power to check the amplifiers without running the tape transport. A BIAS DISABLE switch enables signal head currents to be measured at the HEAD MONITOR jacks. Control functions are interlocked and have mode

delays to prevent malfunction from any incorrect sequence of operation. A SAFETY switch, actuated by a spring-loaded arm in the tape path stops all tape motion if the tape breaks or tape tension falls below the absolute minimum.

1.12 Remote: The Tape Transport can be operated from distances of up to 25 feet, when used with a Remote Control Unit. The remote unit (see figure 1-4) consists of: six backlighted pushbuttons which function as their local counterparts, a fault indicator, and a tape remaining meter.

1.13 RECORD/REPRODUCE ELECTRONICS. The CP-100 uses solid-state electronic components throughout the equipment to provide maximum reliability and minimum weight, heat generation, distortion and drift. Record and reproduce circuits are mounted on plug-in cards, (figure 1-5) which are interchangeable with other cards of the same type. An extender card is provided with each machine to provide access to the circuits of the plug-in cards while they are operating. All test points and adjustments are available at the front of the unit.

1.14 RECORD AMPLIFIERS. All Record Amplifiers, regardless of type, are constructed on plug-in circuit cards which mate with matching receptacle connectors in the card rack located on one side of the control cluster (see figure 1-1). Amplifiers are available for Direct, FM and PDM applications.

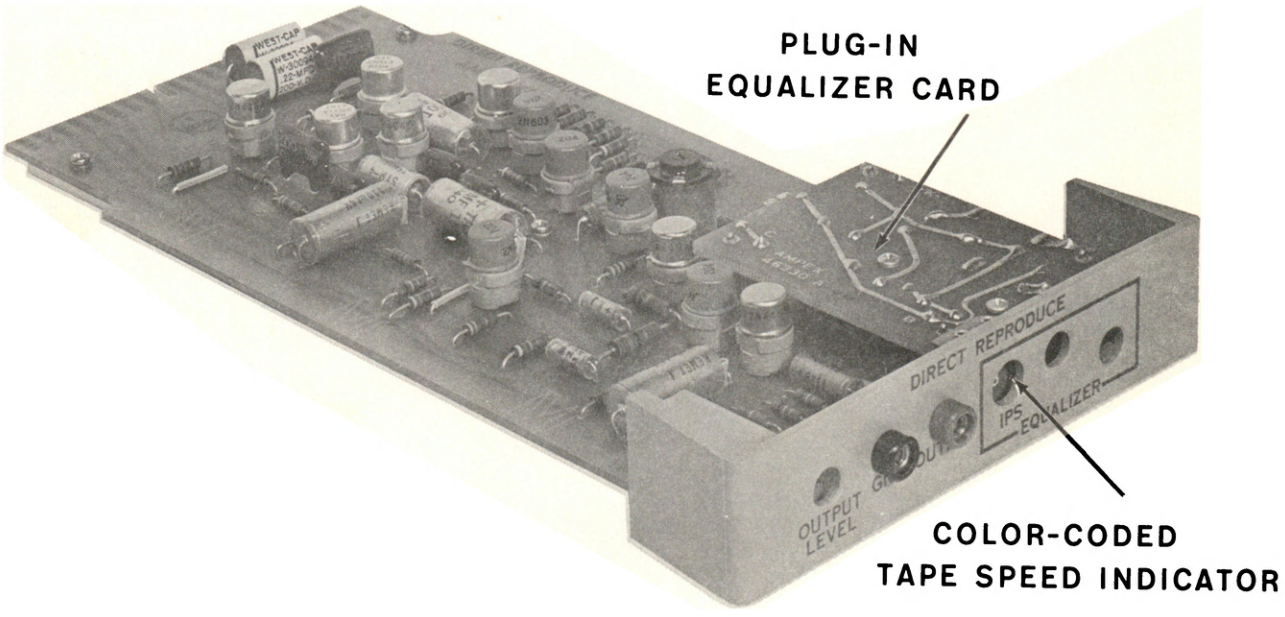
(a) The Direct Record Amplifiers accept wideband data signals which are mixed with the 1.0 mc bias signal from the master bias oscillator to drive the record heads.

(b) The FM Record Amplifiers develop a carrier frequency which is frequency-modulated by an input data signal. Separate plug-in frequency determining units are available for each tape speed.

(c) The PDM record amplifiers differentiate the input waveform so that the positive and negative spikes are recorded onto the tape.

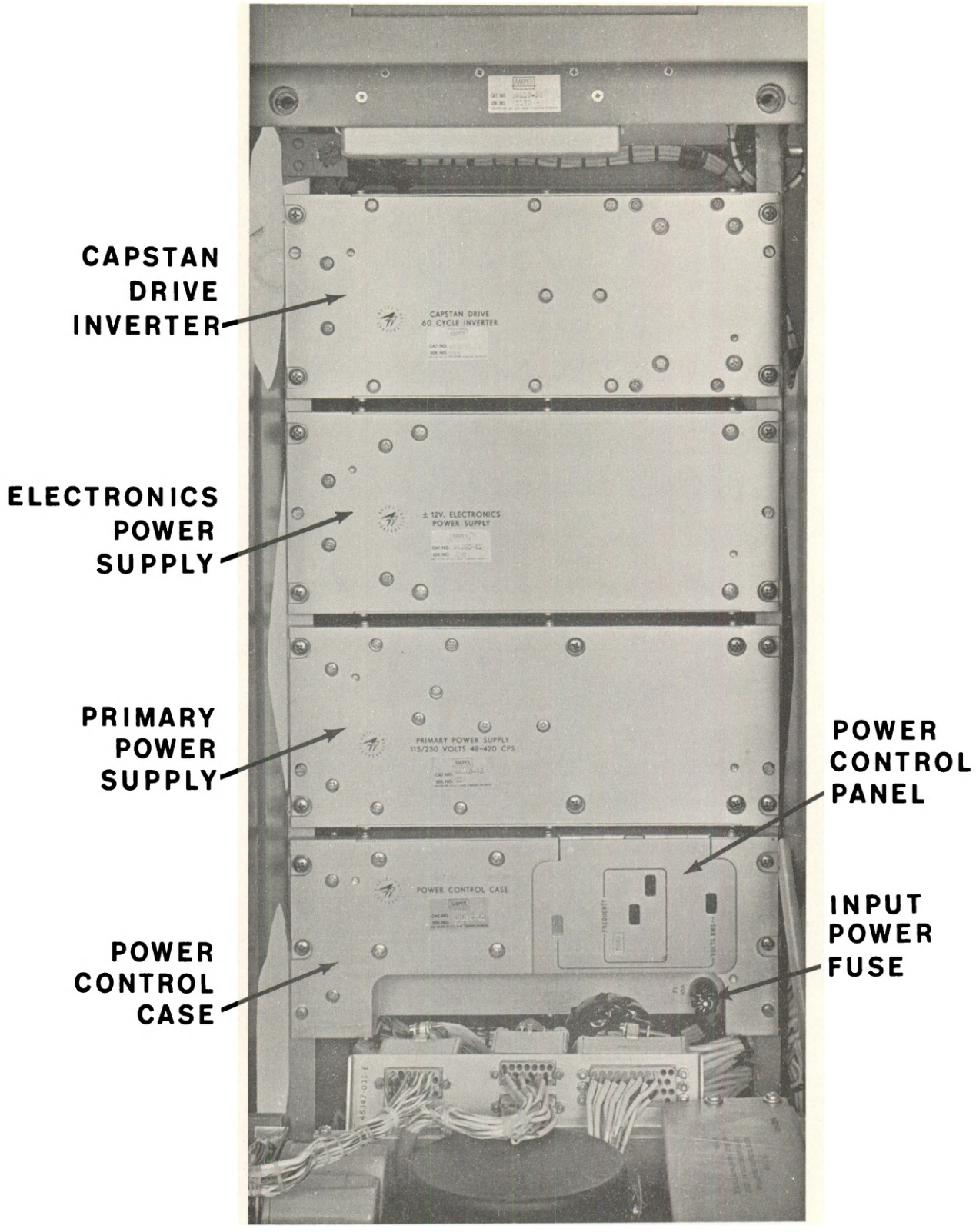
8390-0

Figure 1-4. Remote Control Unit



7899-4

Figure 1-5. Typical Plug-in Amplifier Card



8298-6

Figure 1-6. Transport Open - Location Power Supplies

1.15 MASTER BIAS OSCILLATOR. The Master Bias Oscillator is constructed on an etched circuit board within an aluminum case mounted on the frame. The unit consists of a 1.0 mc crystal oscillator and a power amplifier which provides a bias signal drive to all the direct record amplifiers.

1.16 CONTROL TRACK GENERATOR CARD. In certain applications, it is essential that instantaneous tape speeds during recording and reproduction be the same at all times. Any compensation required, because of tape dimensional changes, can be made by a phase comparison between a precision frequency standard and a modulated control track frequency which has been recorded onto the tape.

1.17 The Control Track Generator Card is used in conjunction with a Direct Record Amplifier to record the control track frequency onto the tape. No reproduce speed servo system is incorporated in the CP-100.

1.18 REPRODUCE PREAMPLIFIERS. The Reproduce Preamplifiers are mounted, three or four to a card, on plug-in cards. Up to four cards may be plugged in the shielded preamplifier housing directly behind the head assemblies. Each Reproduce Preamplifier amplifies the signal from a reproduce head and feeds the output to a Reproduce Amplifier.

1.19 REPRODUCE AMPLIFIERS. The Reproduce Amplifier Cards (see figure 1-1) plug into the card rack on one side of the control cluster.

(a) Direct Reproduce Amplifiers accept wideband data from the Reproduce Preamplifiers, amplify the signal and provide frequency equalization and phase correction. Separate plug-in equalizers are available for each tape speed.

(b) FM Reproduce Amplifiers accept a frequency modulated carrier from the Reproduce Preamplifiers and demodulate the carrier to provide an analog output. Separate plug-in data output filters are available for each tape speed.

(c) PDM Reproduce Amplifiers reconstruct the differentiated waveforms into rectangular data pulses.

1.20 POWER SUPPLIES

1.21 The CP-100 contains three separate power supply units and a power control case,

which are mounted on the main frame behind the Tape Transport (see figure 1-6).

1.22 PRIMARY POWER SUPPLY. The Primary Power Supply provides a nominal 28 vdc (magnetic amplifier regulated at 26-31 volts) to power the entire CP-100. The unit will accept line inputs of either 115 or 230 volts rms at a frequency of 50, 60, or 400 cps. It consists of a main base plate on which are mounted the transformers, rectifiers, filtering components, and regulator components. All components are housed in a drawn aluminum case.

1.23 ELECTRONICS POWER SUPPLY. The electronics power supply is a well regulated power supply which accepts a 28 vdc input from the main power supply or an external power source, and delivers +12 and -12 vdc to the record and reproduce amplifiers, the master bias oscillator and the preamplifiers. It is housed in a drawn aluminum case and consists of a main base plate on which are mounted a chopper, regulator transistors, and associated filter and electronic components.

1.24 CAPSTAN DRIVE INVERTER. The Capstan Drive Inverter is a crystal-controlled power oscillator which supplies 115 volts ±2% at a frequency of 60 cps ±0.01% to drive the capstan motor. The unit consists of a chassis plate to which power transistors, thermal cutouts and transformers are attached. The plate also supports an etched circuit board which contains an oscillator, dividers, amplifiers, and regulator electronics components. All are housed in a drawn aluminum case.

1.25 POWER CONTROL CASE. The power and control case performs the necessary circuit switching which allows the CP-100 to operate from a 50/60 cycle, 120 volt source, 50/60 cycle, 220 volt source, 380/420 cycle, 110 volt source, 380/420 cycle, 220 volt source, and a 28 vdc source. All components of the unit are mounted on a main base plate which is housed in a drawn aluminum case.

1.26 SPECIFICATIONS

1.27 Minimum specifications require that the CP-100 Recording System operate over the range of the described environments.

1.28 ENVIRONMENTAL CONDITIONS

	Operation	Non-Operation
Temperature	40° to 125°F	-20° to 160°F
Humidity	90% Relative non-condensing Humidity -5 to +0%	
Altitude	0 to 10,000 ft.	0 to 20,000 ft.

MAXIMUM CUMULATIVE FLUTTER (% PEAK-TO-PEAK)

TAPE SPEED IPS	BANDPASS CPS	FLUTTER % P-P	BANDPASS CPS	FLUTTER % P-P
60	0.2-10,000	0.50	0.2-312	.17
30	0.2- 5,000	0.55	0.2-312	.25
15	0.2- 2,500	0.60	0.2-312	.35
7-1/2	0.2- 1,250	0.60	0.2-312	.45
3-3/4	0.2- 625	1.00	0.2-312	.85
1-7/8	0.2- 3.2	1.00	0.2-312	1.00

1.29 POWER REQUIREMENTS. Will operate (without modification) on 28 volt dc or on 115 or 230 volt, 48 to 420 cps ac. Power required to operate a 14-channel record/reproduce system will not exceed 400 watts.

1.30 TAPE TRANSPORT

Tape Speeds	60, 30, 15, 7-1/2, 3-3/4, 1-7/8 ips.
Tape Speed Deviation	±0.25% of nominal speed at all recording speeds.
Tape Specification	1/2-inch or 1-inch, 0.001 or 0.0015 inch; maximum temperature, 140°F.
Reel Sizes	10 1/2-inches maximum diameter (NARTB or AMPEX precision reels).
Cumulative Flutter (See table above)	Measured when using AMPEX 741 1.0 MIL instrumentation tape. Low cut-off frequency +0.2 cps.
Start Time	5 seconds to reach a stable 60 ips tape speed. Faster start time with lower tape speeds.
Stop Time	2 seconds maximum from 60 ips tape speed. Faster stop times with lower tape speeds.
Fast Forward	Fast Forward Time (at approximately 250 ips). 3.15 minutes for 3,600 feet of tape.

1.31 HEAD ASSEMBLIES

Head Geometry

Gap Scatter, trailing edges within a band of 100 micro-inches wide (0.0001 inch).

Gap Azimuth, all stacks within ±1 minute of perpendicular to the head mounting plate.

Track Dimensions				Track	
Tape Width	Track	Type	Arrangement	Spacing	Width
*1/2-inch	4	Analog	In-line	0.110 in.	0.050 in.
*1/2-inch	4	Analog	In-line	0.140 in.	0.050 in.
**1/2-inch	7	Analog	Staggered	0.070 in.	0.050 in.
* 1-inch	14	Analog	In-line	0.070 in.	0.050 in.
** 1-inch	14	Analog	Staggered	0.070 in.	0.050 in.

* Special
** Standard

1.32 DIRECT RECORD/REPRODUCE SYSTEM

Signal Input Level	0.25 to 10 volts rms for 1.5 ma record current.
Signal Input Impedance	Minimum 18,000 ohms in parallel with 275 μμfd, unbalanced to ground.
Signal Output Level	1 volt rms (nominal) across a 10,000 ohm impedance at normal recording level.
Output Impedance	Less than 100 ohms.
Dynamic Range and Frequency Response	Signal-to-noise ratio varies widely according to the defined limits between which it is measured, therefore it is best expressed graphically. See key below.

Signal-to-noise parameters shown graphically (in figure 1-7 thru 1-12) represent statistical averages of a large number of units tested and do not represent minimum guaranteed performance.

A. Frequency response at normal record level maximum 1.4% 3rd-harmonic distortion at 30 ips and 500 cps.

B, C, D, E, and F. System noise (rms measured at the output of a bandpass filter having an attenuation rate of 19 db per octave beyond the band limits indicated).

G. Systems noise (rms) measured in half-octave bands.

NOTE

Shaded areas represent specification tolerances.

1.33 CONTROL TRACK GENERATOR

Input

Sensitivity	1.75 volts rms minimum; 3 volts rms supplied by Capstan inverter.
Impedance	10,000 ohms, unbalanced.
Frequency	60 cps ±.02% (obtained from capstan drive inverter).

Output

Voltage	Normally set for 5 volts (can be adjusted from 0 to 20 volt PP).
Impedance	1500 ohms.
Modulation	Normally set for 50% ±5%.
Sub-Carrier Frequency	18,240 cps ±0.05% or 17,000 cps ±0.05%, (selected at time of purchase by separate part numbers; see Parts List).
Distortion	Sub-carrier, less than 1.5% total harmonic distortion.

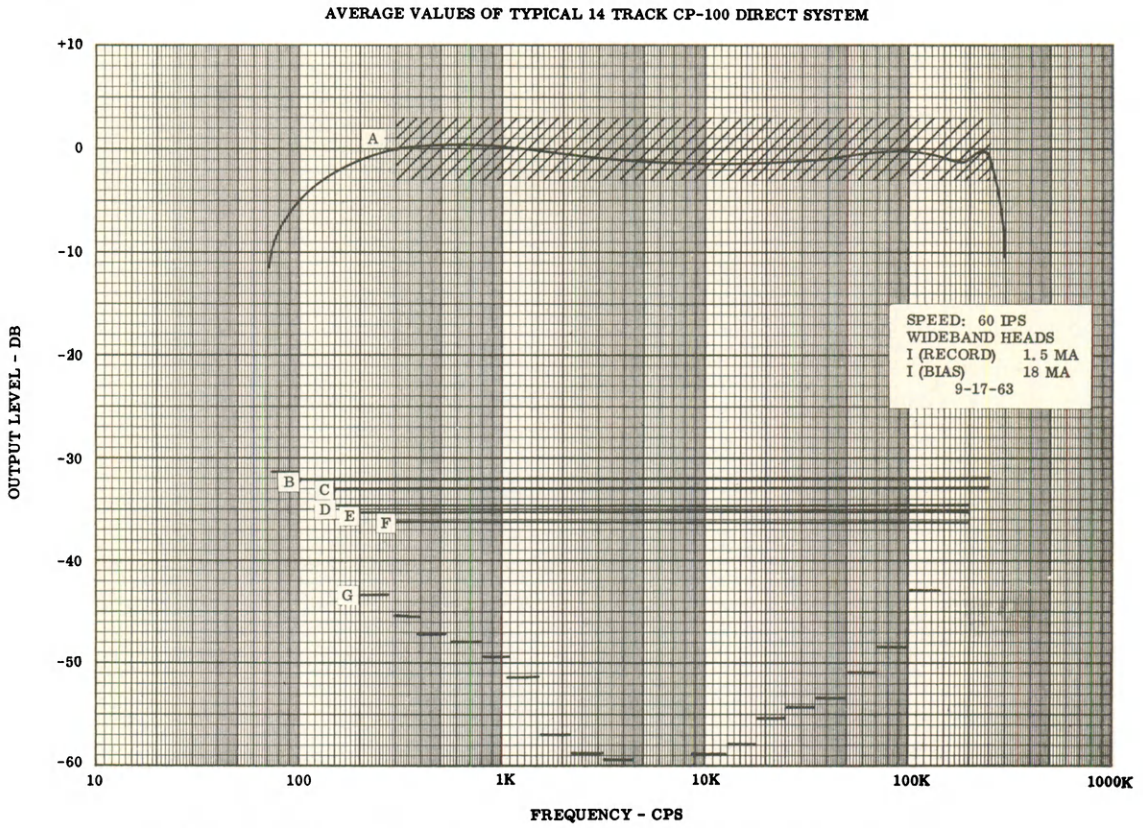


Figure 1-7. Frequency Response for 60 ips Operation 50940

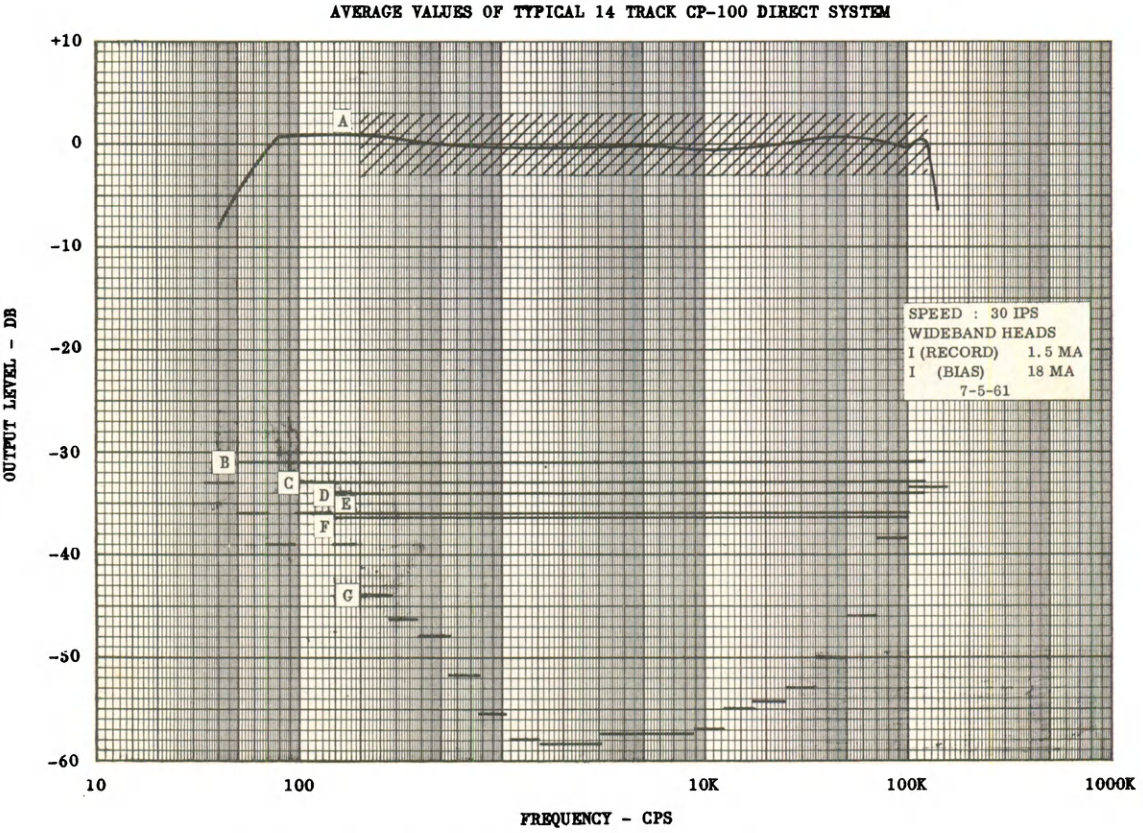


Figure 1-8. Frequency Response for 30 ips Operation 50941

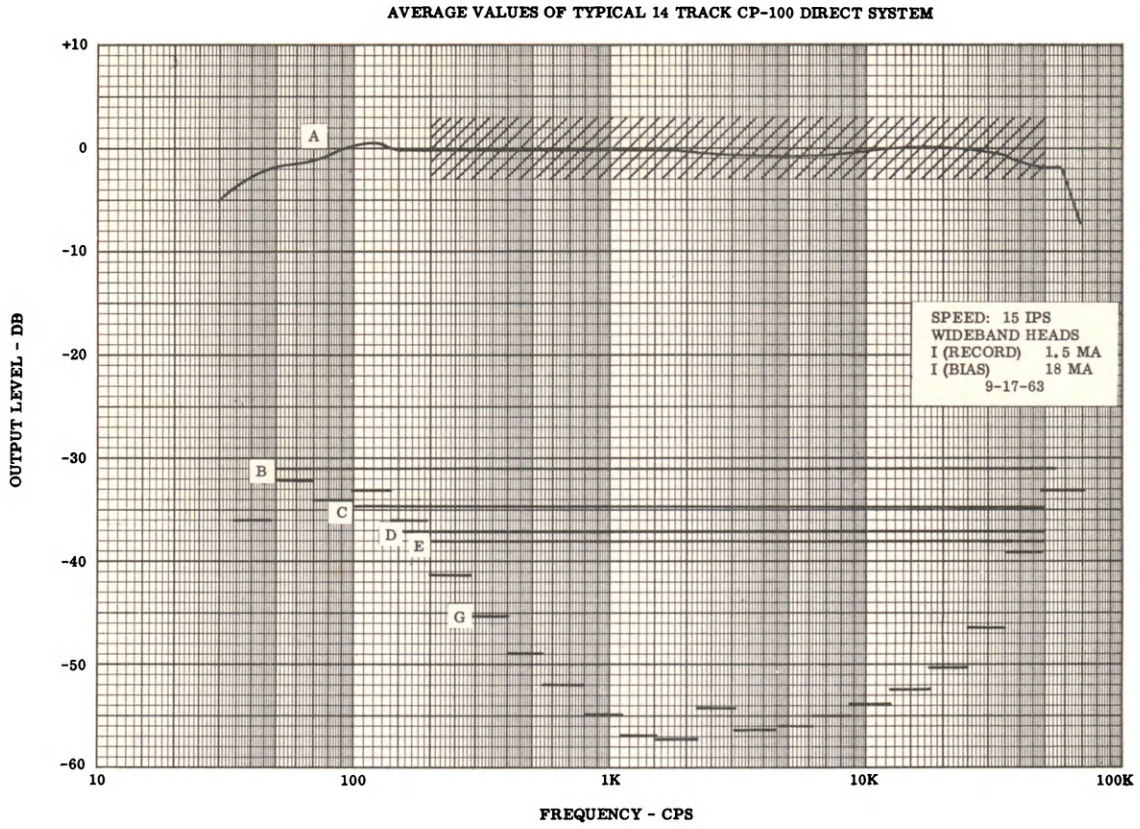


Figure 1-9. Frequency Response for 15 ips Operation

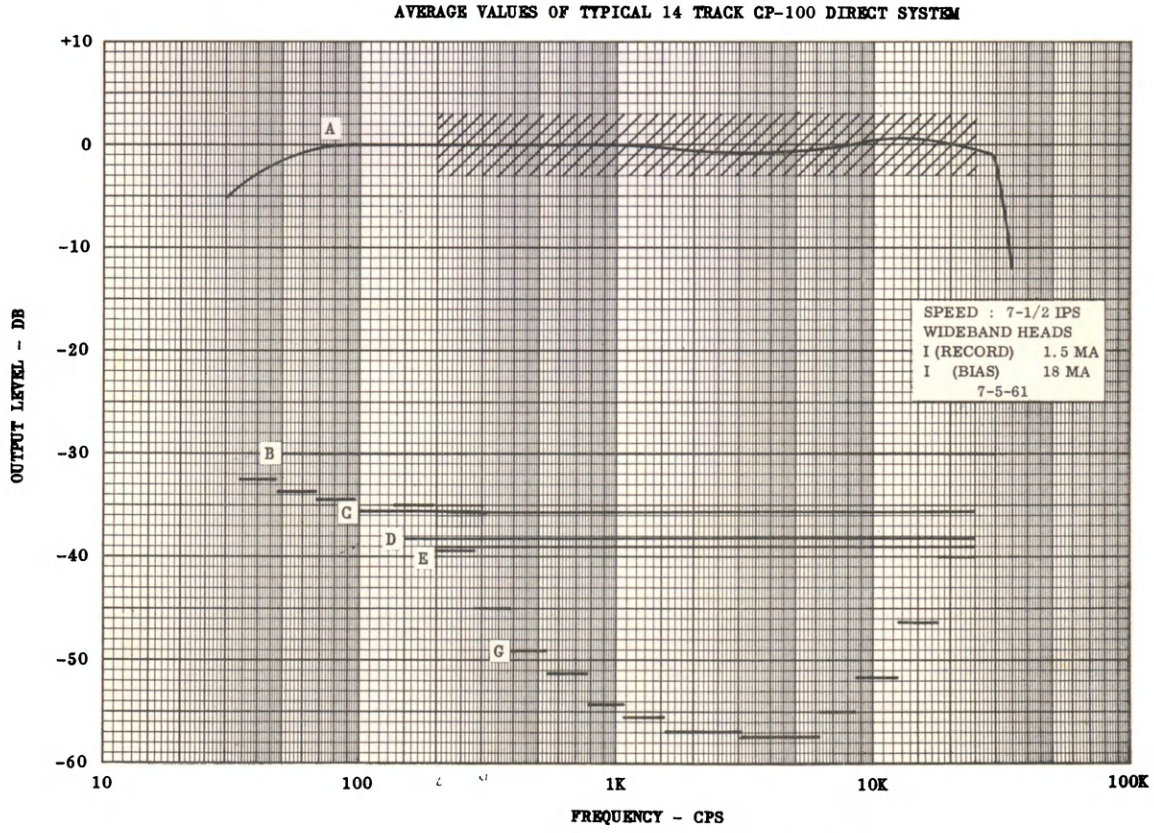


Figure 1-10. Frequency Response for 7-1/2 ips Operation

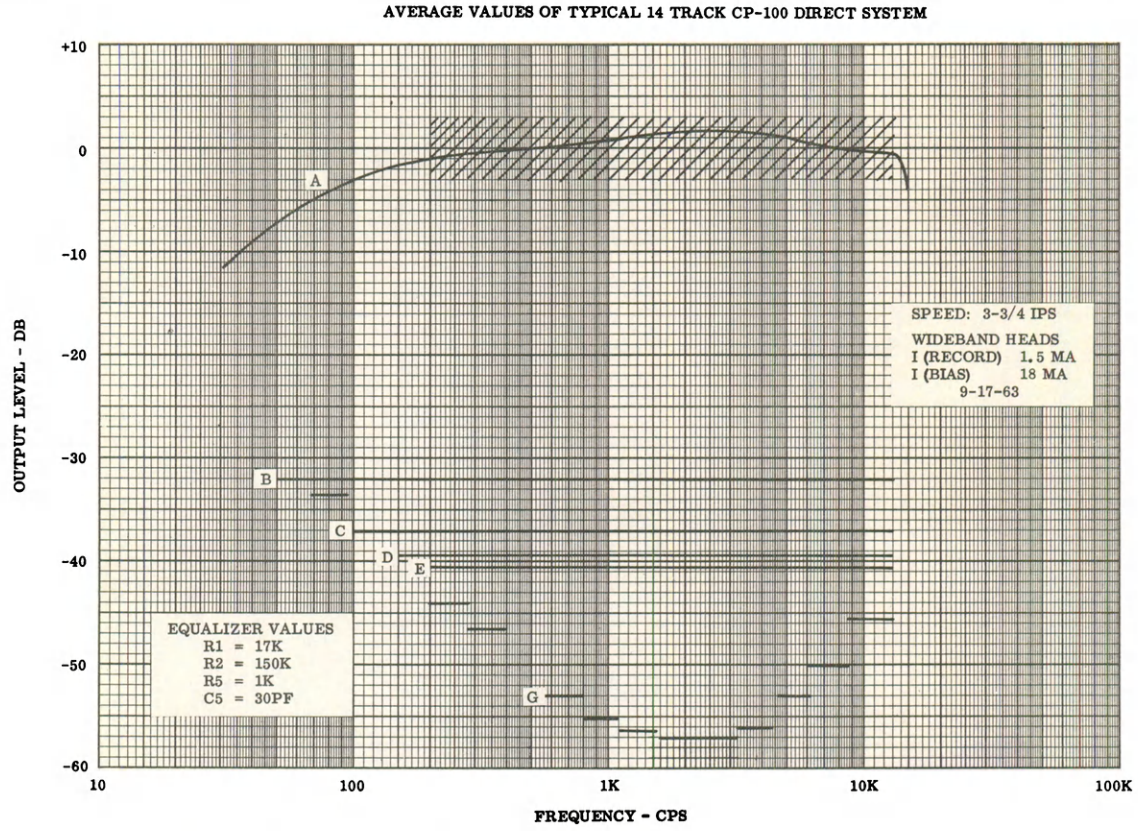


Figure 1-11. Frequency Response for 3-3/4 ips Operation

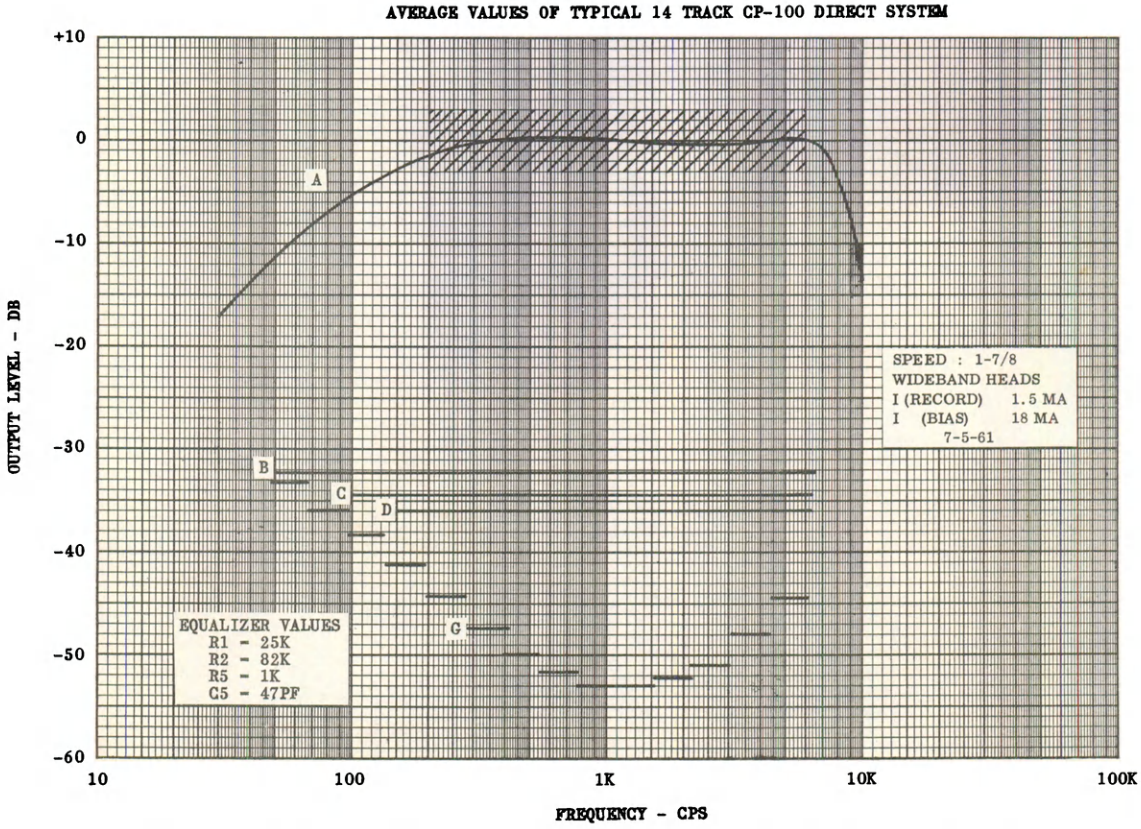


Figure 1-12. Frequency Response for 1-7/8 ips Operation

1.34 FM RECORD/REPRODUCE SYSTEM

Frequency Response — The following table gives the record/reproduce data bandwidth for all standard tape speeds with total harmonic distortion of no more than 2%. State passbands are flat within 1.0 db and signal-to-noise figures are rms values with an undeviated carrier.

Tape Speed	Band Width	S/N
60	0-20 kc	46 db
30	0-10 kc	46 db
15	0- 5 kc	46 db
7-1/2	0- 2.5 kc	45 db
3-3/4	0-1250 cps	42 db
1-7/8	0- 625 cps	42 db

Signal Input Level — Normal (±40%) deviation with inputs from 0.5 to 25.0 volts rms.

Signal Input Impedance — Minimum 18,000 ohms in parallel with 275 μμfd, unbalanced to ground.

Signal Output Level — 1 volt rms (nominal) across a 10,000 ohm impedance at normal recording level.

Output Impedance — 1000 ohms or less, dc to 20 kc; unbalanced to ground, (a function of gain potentiometer).

System Drift — Less than 1% after warm-up with line voltage and temperature constant for 8 hours. Less than 2% with line variations between 105 and 125 volts and temperature variations between 40° and 125°F for 8 hours. Warm-up time nominally 5 minutes.

Record/Reproduce — dc, ±1% of full deviation of a zero-based straight line.

Voltage Linearity — ac, ±1% of full deviation of best straight line.

1.35 PDM RECORD/REPRODUCE SYSTEM

System pulse characteristics:

Tape Speed	Pulse Duration (in microseconds)		Pulse accuracy in microseconds over specified pulse widths
Ips	Min.	Max.	
60	20	10,000	±2.0 (50 to 900 usec duration)
30	40	10,000	±2.0 (50 to 900 usec duration)

Tape Speed	Pulse Duration (in microseconds)		Pulse accuracy in microseconds over specified pulse widths
Ips	Min.	Max.	
15	80	10,000	±3.0 (100 to 2,000 usec duration)
7-1/2	160	10,000	±10 (200 to 3,000 usec duration)

Input Level and Range:	1.0 volt zero-to-peak nominal; 1 to 25 volts zero-to-peak (input attenuator must be adjusted to 1 volt for any input voltage from 1 to 25 volts).
Input Impedance:	20,000 ohms, unbalanced to ground, in parallel with 275 μμf.
Input Rise and Fall Time:	(10% to 90% amplitude level) 2.0 microseconds maximum (to maintain specified systems accuracy).
Output Level:	20 volts, minimum zero-to-peak into 1,000 ohm resistive load (AC coupled).
Output Impedance:	100 ohms maximum.
Output Pulse Rise and Fall Time:	2.0 μ seconds or less from 10% to 90% amplitude level.
Pulse Return Duration:	Adjustable from 200 to 10,000 μ seconds.
Maximum Duty Cycle:	85% (900 pps data rate).

1.36 LIST OF CP-100 COMPONENTS AVAILABLE

CATALOG NO.	NOMENCLATURE
46365-5	Tape Transport 1-inch
46365-6	Tape Transport 1/2-inch
46410-2	Frame Assembly
46364-2	Case Assembly
46372-2	Cover Assembly
46260-2	Direct Record Amplifier
46250-2	Direct Reproduce Amplifier
46330-1	Direct Reproduce Equalizer: 60 ips
46330-2	Direct Reproduce Equalizer: 30 ips
46330-3	Direct Reproduce Equalizer: 15 ips
46330-4	Direct Reproduce Equalizer: 7-1/2 ips
46330-5	Direct Reproduce Equalizer: 3-3/4 ips
46330-6	Direct Reproduce Equalizer: 1-7/8 ips
46300-1	Master Bias Oscillator
46730-3	Control Track Generator Card
1810217-1	FM Record Amplifier

CATALOG NO.	NOMENCLATURE
46280-11	FM Reproduce Amplifier
46390-1	FM Reproduce Filter Unit
46390-2	FM Reproduce Filter Unit
46390-3	FM Reproduce Filter Unit
46390-4	FM Reproduce Filter Unit
46390-5	FM Reproduce Filter Unit
46390-6	FM Reproduce Filter Unit
1810251-01	PDM Record Amplifier
46420-1	PDM Reproduce Amplifier
46290-3	Reproduce Preamplifier, 4 channel
46290-4	Reproduce Preamplifier, 3 channel
46360-1	AC/DC Power Converter (Primary Power Supply)
46380-1	Electronics Power Supply
46370-1	Capstan Drive Inverter (Motor Drive Amplifier) 60 cps
48630-1	Power Control Case
46382-1	Electronics Extender Board
46421-1	Dummy Amplifier Card
48641-2	Accessory Kit
126051-02	Installation Kit, Rack Mounting
68625-04	Instruction Manual
48460-1	Remote Control Unit

1.37 LIST OF HEAD ASSEMBLIES AVAILABLE

CATALOG NO.	FUNCTION	WIDTH	NUMBER OF CHANNELS	FORMAT	TYPE
120115-010	Reproduce	1"	14	Ampex Std.	Wide-band
120115-020 ✓	Reproduce	1"	14	IRIG	Wide-band
120115-030	Reproduce	1/2"	7	Ampex Std.	Wide-band
120115-040	Reproduce	1/2"	7	IRIG	Wide-band
120115-050	Reproduce	1"	14	Ampex Std.	Std. -band
120115-060	Reproduce	1"	14	IRIG	Std. -band
120115-070	Reproduce	1/2"	7	Ampex Std.	Std. -band
120115-080	Reproduce	1/2"	7	IRIG	Std. -band
23595-70	Record	1"	14	Ampex Std.	Wide-band
23754-60 ✓	Record	1"	14	IRIG	Wide-band
23595-90	Record	1/2"	7	Ampex Std.	Wide-band
23754-80	Record	1/2"	7	IRIG	Wide-band
23596-92	Dummy Head Assembly - 1-inch				
23596-82	Dummy Head Assembly - 1/2-inch				

CHAPTER TWO

INSTALLATION

2.1 UNPACKING

2.2 Each CP-100 Recorder/Reproducer System is packed in a special custom-built packing case designed to provide maximum protection during shipment. EXERCISE THE UTMOST CARE DURING UNPACKING SO THAT THE EQUIPMENT IS NOT DAMAGED. Check the contents carefully against the packing list and for possible damage incurred during shipment. If it is anticipated that the equipment will be moved another time, save the packing case.

2.3 LOCATION

2.4 Generally, the CP-100 may be installed wherever temperature and humidity do not exceed the specifications listed in Chapter One. The system may be operated vertically, horizontally or on a rolling dolly; it may also be mounted without its case in 19 x 31 inches of rack space, or may be bolted directly to a wall or bulkhead.

NOTE

If the Recorder/Reproducer is to be rack-mounted (without the case) an installation kit, Part No. 126 021 020, which contains the required parts for cooling and mounting, must be used.

2.5 Atmospheres containing corrosive fumes, such as those in the proximity of storage batteries, should be avoided. The presence of dust during the loading and unloading of tape reels may cause drop-out problems. Strong magnetic fields can deteriorate the recorded signal and magnetize the head assemblies, tape guides, and capstan. Avoid locating the equipment near such fields.

2.6 STORAGE

2.7 If the equipment is to be stored for a period of time in excess of seven days, precautions must be taken to protect the equipment and prevent the entry of moisture or dust and consequent deterioration of the recorder/reproducer. When a long period of storage is anticipated, the following precautions should be observed:

(a) Equipment covers should be properly in place.

(b) Dust caps for receptacle connectors should be installed to protect connector pins and threads.

(c) Head Assemblies should be removed and wrapped in a soft lint-free material.

(d) Complete equipment should be stored in its original shipping container.

NOTE

If storage is anticipated under conditions of high humidity and dust, the storage container (containing a suitable desiccant) should be sealed air-tight.

2.8 MOUNTING

2.9 Figure 2-1 shows the outline and dimensions of the CP-100 system. In locating the system contained in the CP-100 case, a 2-inch air-space must be left at the top and sides to permit adequate circulation of cooling air. The only other clearance required is sufficient room to open the case cover door to its widest point and to swing the transport out of the case.

2.10 If the system is to be rack-mounted without its case, no special clearance requirements need be observed, assuming that adequate room is provided for swinging the transport out of the frame. Figure 2-1 shows the location of mounting holes for bulkhead mounting. The system may be bulkhead-mounted in this manner either with or without the case.

WARNING

TO PREVENT DAMAGE TO EQUIPMENT AND INJURY TO PERSONNEL, INSTALLATION KIT, Part No. 126 021 020 MUST BE USED IF THE CP-100 RECORD/REPRODUCER SYSTEM IS RACK-MOUNTED.

2.11 TRACK ARRANGEMENTS

2.12 With the CP-100 Recorder/Reproducer, a large number of track arrangements may be used. Certain factors should be considered if optimum results are to be obtained. Do not make track arrangements in which saturation recording techniques (FM) are alternated with non-saturation recording techniques (Direct). If possible, group such arrangements together, so that all Direct tracks are together, etc. This arrangement will hold inter-channel crosstalk to a minimum.

NOTE

If a control track is desired for servo tape speed control, this control track should be recorded preferably on an outside track, i.e., track 7 or 14.

2.13 HEAD INSTALLATION

2.14 The Head Assemblies are installed in the following manner on the top of the tape transport casting. A hexagonal wrench, located under one of the head covers, is provided for tightening of the mounting screws.

Step 1: Remove the head covers by unscrewing the two cross-recessed drive screws.

Step 2: Mount the Head Assemblies onto the casting and secure in place by using the three socket head cap screws for each Head Assembly.

Step 3: Insert the plug connectors from the Head Assemblies into the respective mating receptacle connectors.

Step 4: Replace the head covers and secure in place by tightening the two cross-recessed drive screws.

NOTE

No further alignment of the head stacks is required, since this has been accomplished when the head stacks were secured to the mounting plates at the factory.

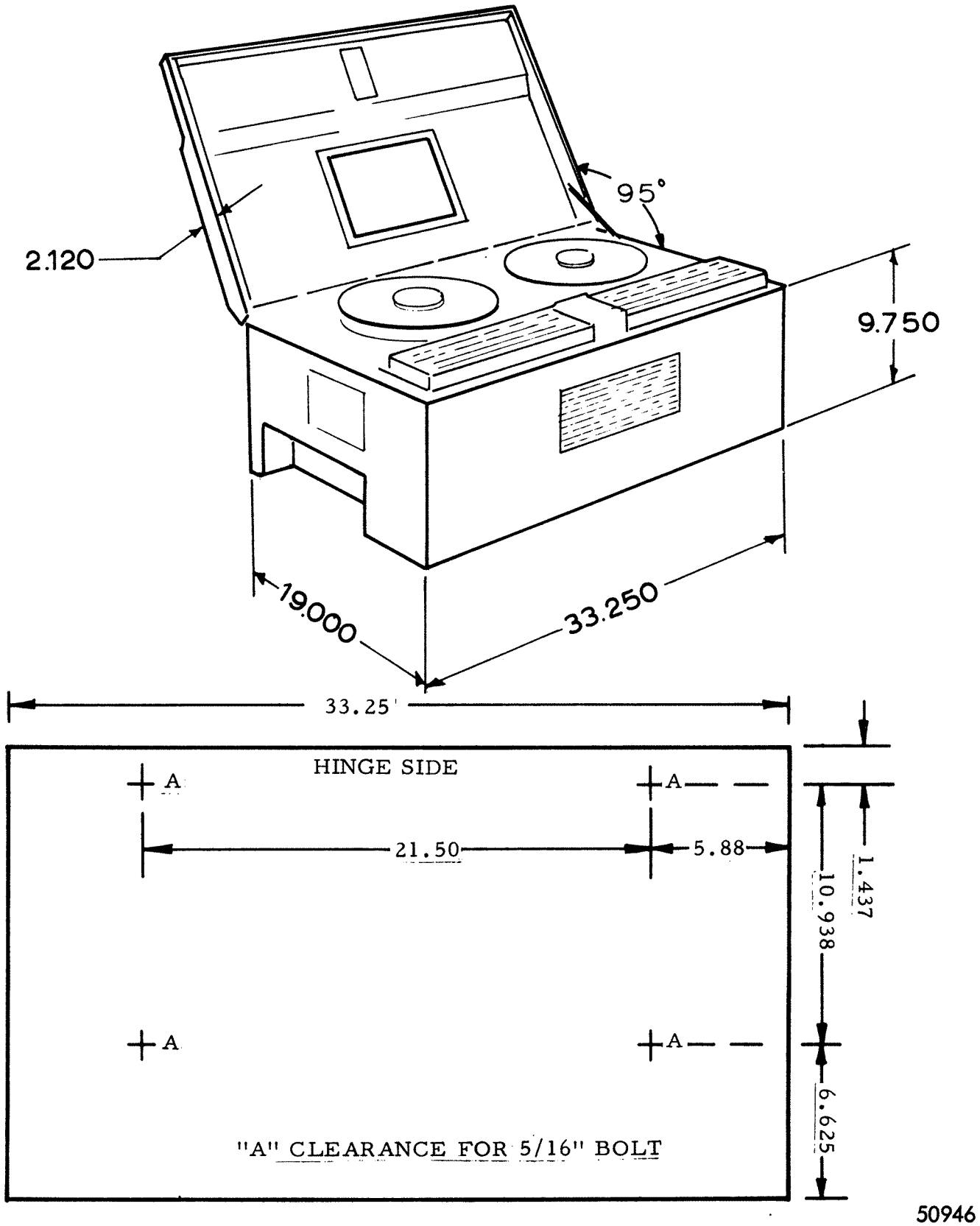
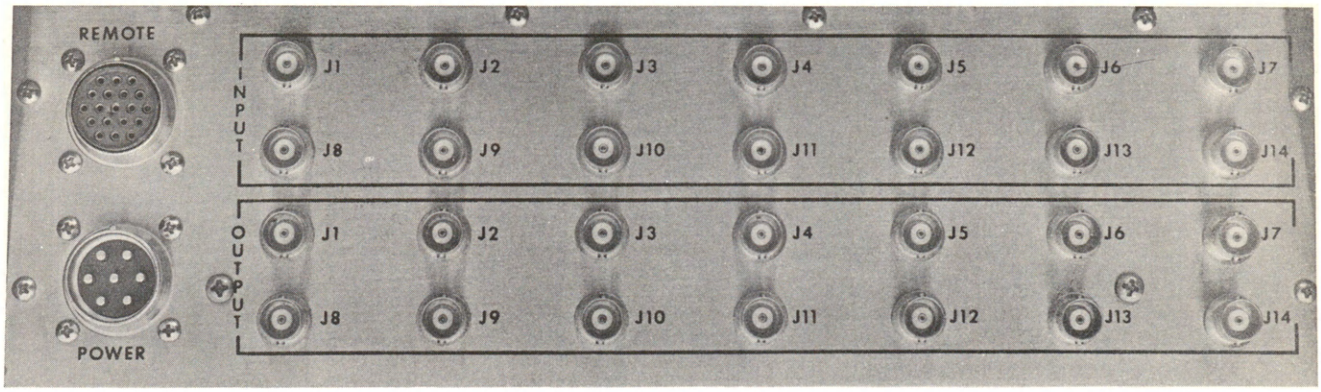


Figure 2-1. Outline and Location of Holes for Bulkhead Mounting

2.15 ELECTRONICS INSTALLATION

2.16 The record/reproduce amplifiers are installed in card racks located on either side of the control cluster at the front of the Tape Transport. Record amplifiers are housed below (left side) the control cluster, adjacent to the take-up reel and reproduce amplifiers are housed above (right side) the control cluster, adjacent to the supply reel.

2.17 Signal connections are made at a connector panel (see figure 2-2) which is located on the take-up reel end of the frame assembly. The INPUT section of the panel contains 14 BNC connectors marked J1 through J14, each of which corresponds to a channel number on the record card rack. The OUTPUT section also contains 14 BNC connectors marked J1 through J14, each of which corresponds to a channel number on the reproduce card rack. In addition, the panel contains the input power receptacle and remote control receptacle.



8298-7

Figure 2-2. Connector Panel

2.18 REMOTE CONTROL UNIT INSTALLATION

2.19 When the remote control unit is used, connect plug P15 of the remote unit to receptacle J15 on the tape transport frame assembly. Receptacle J15 is located on the connector panel, (see figure 2-2) directly above the power input receptacle. When the remote unit is not used, a dummy plug must be inserted into receptacle J15. The dummy plug will establish ground continuity for the control circuit.

2.20 POWER REQUIREMENTS

2.21 The CP-100 will operate on 28 volts dc or on 115 or 230 volts, 50, 60, or 400 cps

ac. Make certain that the primary power source can carry the full capacity of the system, including a safety factor for transient power surges during starting operations.

2.22 When operating from 28 volts dc, the CP-100 primary power supply will not be required. However, for optimum performance, the 28 volt dc power supply should not exceed 0.5 volt peak-to-peak ripple.

2.23 When operating from 115 or 230 volts ac, a primary power supply is required. In addition, use of the capstan drive inverter is recommended since quoted performance specifications are based upon its inclusion in the system. However, use of the capstan drive inverter is optional; without it, system performance will depend on the frequency stability of the input power. When the capstan drive inverter is not used, the inverter dummy plug must be inserted in its receptacle connector.

CAUTION

IF THE BLOWERS ARE DISCONNECTED WHEN THE SYSTEM IS OPERATING FROM A 28 VDC OR 400 CPS POWER SOURCE, THE BLOWER POWER INVERTER CIRCUIT MUST BE DISABLED. THIS IS DONE BY REMOVING THE JUMPER BETWEEN PINS M AND N OF P211 (FREQUENCY SELECT PLUG ON POWER CONTROL). FAILURE TO REMOVE THIS JUMPER MAY RESULT IN DAMAGE TO THE BLOWER INVERTER TRANSFORMER.

2.24 POWER PLUG CONNECTIONS

2.25 A power plug (P17) (AMPEX Part No. 144-091 — Deutsch DM 9702-1A) is provided for making input power connections. The plug to be wired as shown in Table 2-1. For operation at 120 V ac, Cable Assembly, AMPEX Part No. 126 815 can be used.

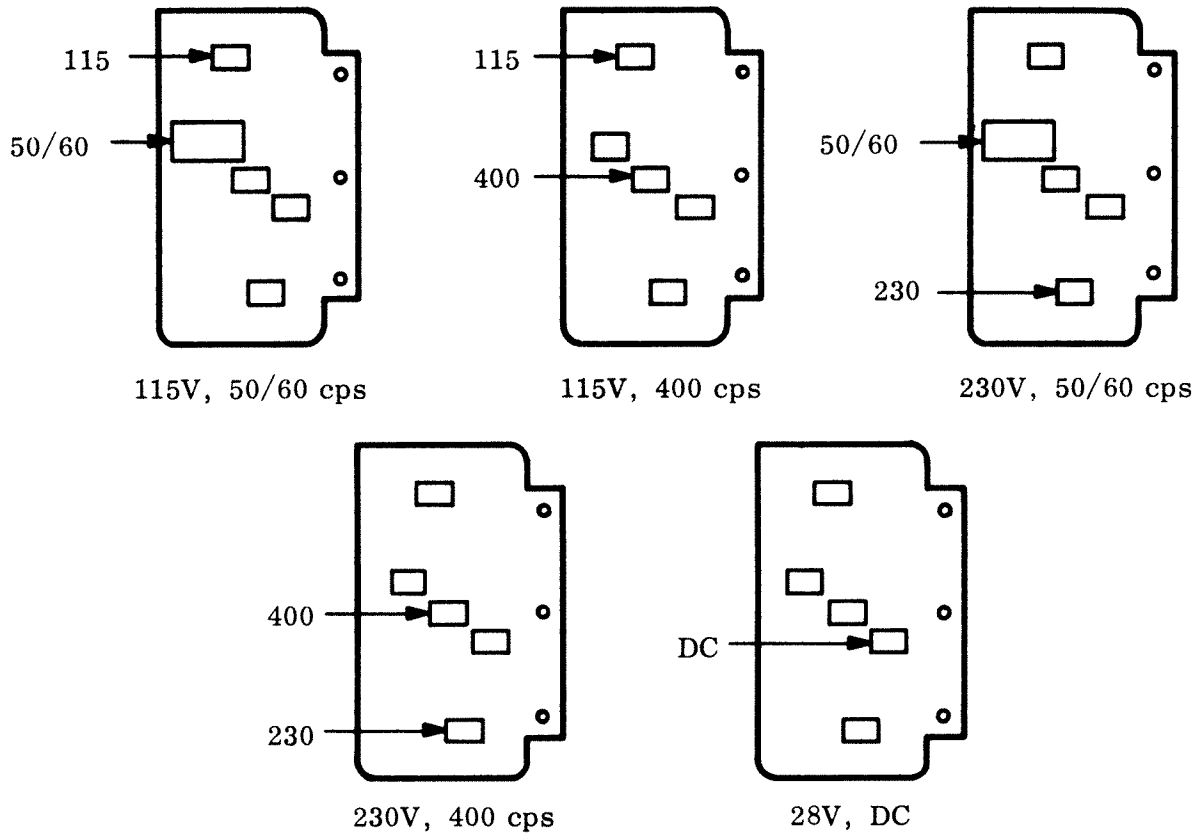
Table 2-1. Power Plug Connections

Power Input	Connect to Pin (P17)		Notes
26-30 vdc, 10 amps max.	28 V -28 V	2 1	Pin 1 is grounded internally.
105-125 vac 48-400 cps	Hot Neutral Ground	7 3 1	
105-125 vac 60 cps precision frequency source	Hot Neutral Ground	7 3 1	Capstan inverter jumper plug may be used if desired.
210-250 vac 48-400 cps	Hot Neutral Ground	7 3 1	
210-250 vac 60 cps precision frequency source	Hot Neutral Ground	7 3 1	Capstan inverter jumper plug may be used if desired.

2.26 In addition to the connections shown in Table 2-1 for the power input plug, the power control case selector plugs must be placed in the appropriate position for the type, voltage and frequency of the power source used. The selector plugs are placed in the position corresponding to the type of input power being used as shown in figure 2-3. When 28 volts dc input power is used, the voltage selector plug may be left in either position.

NOTE

The remote control jumper plug, catalog no. 48640-1, must be installed into J15 to complete the stop circuit interlock if the remote unit is not used.



50947

Figure 2-3. Power Control Case Jumper Plug Locations

CHAPTER THREE

OPERATION

3.1 GENERAL CONSIDERATIONS

3.2 Before the application of power, the following procedures should be carried out, to complete the system. These procedures include preparing the Tape Transport for operation, and familiarization with the functions of the operating controls. When all installation instructions outlined in Chapter Two have been completed, the system is ready for pre-operational checkout and use.

3.3 PRE-OPERATIONAL PROCEDURES

3.4 Prior to performing preliminary checkout of the equipment, the following pre-operational procedures are to be carried out.

(a) Selection of tape
(b) Tape threading
(c) Speed selection

3.5 **SELECTION OF TAPE.** Only high-quality instrumentation magnetic recording tape should be used with the system. The recommended tape is **AMPEX** 741, a 1.0 mil thick Mylar* base medium. Other tape can be used, but a re-adjustment of bias levels, record levels, etc., may be necessary to achieve optimum operation. It is recommended that all tape be bulk-erased before used for recording.

3.6 **TAPE THREADING.** To thread the tape onto the Tape Transport, as shown in the diagram on the capstan motor cover, the following procedure is to be carried out.

Step 1: Turn the tape follower arm clockwise so that it locks in a position to clear the outside diameter of the full reel of tape.

* Trademark, Dupont

Step 2: Turn the handle of the reel hold-down assembly on the supply reel counterclockwise to retract the three cam-actuated dogs.

Step 3: Place the full reel of tape onto the supply reel turntable and turn the handle of the reel hold-down knob clockwise to engage the cam-actuated dogs in the three grooves in the bore of the reel.

Step 4: Turn the handle of the reel hold-down knob assembly on the take-up reel counterclockwise to retract the three cam-actuated dogs.

Step 5: Place the empty reel onto the take-up reel turntable and turn the handle of the reel hold-down knob clockwise to engage the cam-actuated dogs in the three grooves in the bore of the reel.

Step 6: Unwind sufficient tape from the full reel and thread the tape as follows: around the tension guide, the supply guide, between one of the pinch rollers and the capstan, past the Head Assembly, round the turnaround idler, past the second Head Assembly, between the second pinch roller and the capstan, round the take-up guide, round the safety switch guide post and onto the take-up reel. The complete tape path is shown in figure 3-1.

Step 7: Release the tape follower arm so that the end of the arm rests on the full tape pack.

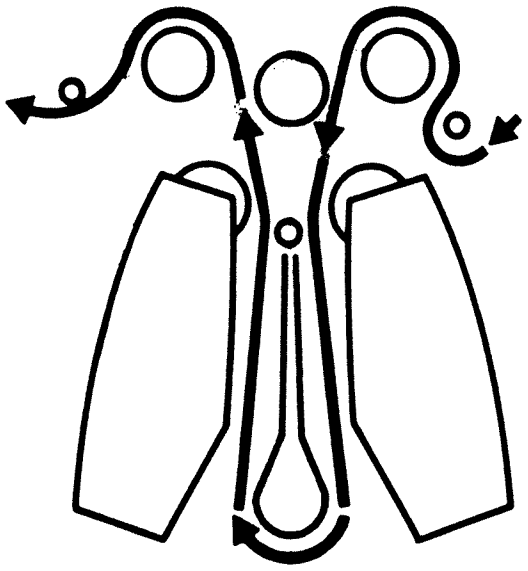


Figure 3-1. Tape Threading Path 50948

3.7 SPEED SELECTION. In preparing the Tape Transport for operation, the following procedure is to be carried out to select the desired tape speed:

CAUTION

DO NOT CHANGE THE POSITION OF THE SPEED SELECTOR SWITCH WHILE POWER IS APPLIED TO THE TAPE TRANSPORT.

Step 1: Open the transport by unlocking the quarter turn fasteners opposite the hinges. When these are released, the transport can be swung out sufficiently to provide access to the jack bar which is hinged to the frame next to the card racks. The right or upper end of the jack bar is latched in place by spring tension. Pressing the upper end towards the amplifier cards will release it and allow it to swing out and engage the snap-slide fastener on the side of the transport.

NOTE

Simplified diagrams of the belt and pulley arrangements are located on the side of the preamplifier housing. Remove belt slack when belts are changed.

Step 2(a): For a tape speed of 60 ips, place the largest belt over the flywheel and the larger step of the spring-loaded intermediate pulley. Place the smallest belt over the drive motor pulley and the smaller step of the intermediate pulley (figure 3-2). Place the SPEED SELECTOR switch in the Brown (60) position.

Step 2(b): For a tape speed of 30 ips, repeat 2(a) above, with the exception that the SPEED SELECTOR switch is placed in the Red (30) position.

Step 2(c): For a tape speed of 15 ips, place the largest belt over the flywheel, the larger step of the spring-loaded intermediate pulley, and the drive pulley (figure 3-3). Place the SPEED SELECTOR switch in the Orange (15) position.

Step 2(d): For a tape speed of 7-1/2 ips, repeat 2(c) above, with the exception that the SPEED SELECTOR switch is placed in the Yellow (7-1/2) position.

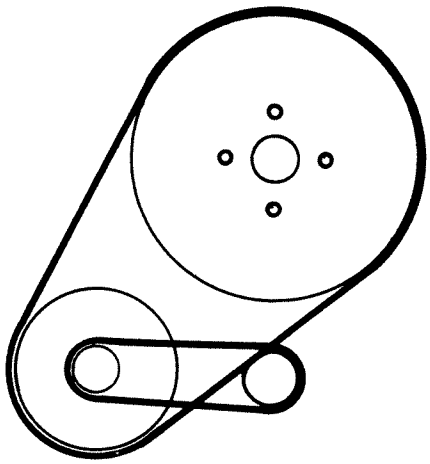
Step 2(e): For a tape speed of 3-3/4 ips, place the second smallest belt over the drive motor pulley and the larger step of the spring-loaded intermediate pulley. Place

the second largest belt over the flywheel and the smaller step of the intermediate pulley (figure 3-4). Place the SPEED SELECTOR switch in the Green (3-3/4) position.

Step 2(f): For a tape speed of 1-7/8 ips, repeat 2(e) above, with the exception that the SPEED SELECTOR switch is placed in the Blue (1-7/8)position.

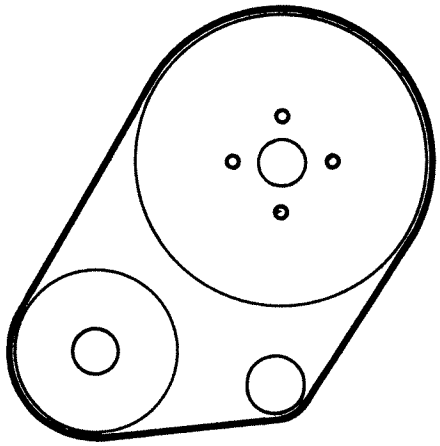
Step 2(g): To re-establish belt tension, position the intermediate pulley hard against the belt in the direction away from the capstan.

Step 3: Return the transport to the frame and secure the transport by locking the quarter -turn fasteners.



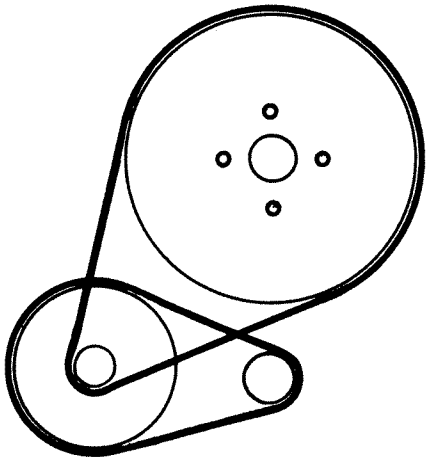
50949

Figure 3-2. Belt Positions: 60 and 30 ips



50950

Figure 3-3. Belt Positions: 15 and 7-1/2 ips



50951

Figure 3-4. Belt Positions: 3-3/4 and 1-7/8 ips

3.8 OPERATING CONTROLS

3.9 **LOCAL.** The Tape Transport operating controls and their functions are shown in Table 3-1.

Table 3-1. CP-100 System Controls

CONTROL	FUNCTION
POWER (ON and OFF)*	Successive operation alternately applied and removes input power.
DRIVE*	Applies power to the take-up motor to start tape motion, and initiates the REPRODUCE mode.
RECORD*	Starts recording operation. Locked out until DRIVE button is pressed.
FAST FORWARD*	Causes tape to move at a high rate of speed from the supply reel to the take-up reel. Over-rides all other controls.
REWIND*	Causes tape to move at a high rate of speed from the take-up reel back to the supply reel. Over-rides all other controls.
STOP*	Stops all tape motion.
TEST/OPERATE	Applies power to the record amplifiers so that record head signals may be checked without running the transport. Must be in OPERATE position for normal system operation.
BIAS DISABLE	Enables checking of direct record head signals with the bias signal removed.
SPEED SELECTOR	Used in conjunction with the belt arrangement to select the desired operating tape speed.

* Backlighted pushbuttons also located on remote control unit.

3.10 **REMOTE.** The operating controls of the remote control unit function as their local counterparts (see table 3-1) with the exception of the fault indicator and tape remaining meter. The fault indicator is illuminated when a malfunction occurs in the operation of the recorder. The function of the tape remaining meter is to indicate the amount of tape remaining on the supply reel.

3.11 SYSTEM OPERATION

CAUTION

PERMANENT MAGNETIZATION OF THE HEADS OR TAPE GUIDE ASSEMBLIES CAN CAUSE DISTORTION OF THE RECORDED SIGNAL OR REDUCTION OF THE SIGNAL-TO-NOISE RATIO. THE FOLLOWING PRECAUTIONS ARE TO BE TAKEN TO AVOID PERMANENT MAGNETIZATION:

a) DO NOT CONNECT OR DISCONNECT SIGNAL INPUT OR RECORD HEAD LEADS WHILE RECORDING.

b) DO NOT TEST CONTINUITY OF THE HEADS WITH AN OHMMETER OR ANY SIMILAR TESTER.

c) DO NOT ALLOW MAGNETIZED OBJECTS TO TOUCH ANY PART OF THE TAPE TRANSPORT.

NOTE

For proper operation of individual record/reproduce amplifiers, the appropriate alignment procedures outlined in Chapter Four of this manual must be performed.

3.12 MODE SELECTION

MODE REQUIRED	DEPRESS	PUSHBUTTON INDICATOR LAMPS ON	PUSHBUTTON INDICATOR LAMPS OFF	REMARKS
POWER ON	POWER pushbutton once	POWER STOP		Power is applied to entire system; cooling fan starts; capstan starts. (Do not press the DRIVE pushbutton until the capstan has reached its operating velocity - approximately 70 seconds for 60 ips).
POWER OFF	POWER pushbutton a second time		ALL	Entire system is de-energized.
REPRODUCE	DRIVE pushbutton	POWER DRIVE STOP	RECORD REWIND FAST FWD	Tape will move from supply to take-up reel. When tape has reached nominal speed, the pinch rollers will clamp the tape against the capstan. The tape will then be pulled past the heads at correct speed. The DRIVE mode is locked out for about 2 seconds after operating in either the FAST FWD or REWIND modes and the STOP pushbutton is depressed.
RECORD	DRIVE pushbutton then RECORD pushbutton	POWER DRIVE RECORD STOP	FAST FWD REWIND	System will enter the RECORD mode. Since the DRIVE pushbutton is also depressed, the recorded signal may be monitored immediately afterwards. NOTE The RECORD pushbutton is electrically locked out unless the tape is in motion in the DRIVE mode.
FAST FORWARD	FAST FORWARD pushbutton	POWER FAST FWD STOP	RECORD DRIVE	Tape will move rapidly from the supply reel to the take-up reel at a speed of approximately 250 ips. The FAST FORWARD pushbutton over-rides all other controls.

MODE REQUIRED	DEPRESS	PUSHBUTTON INDICATOR LAMPS		REMARKS
		ON	OFF	
REWIND	REWIND pushbutton	POWER REWIND STOP	RECORD DRIVE FAST FWD	Tape will move rapidly from the take-up reel to the supply reel at a speed of approximately 250 ips. The REWIND pushbutton over-rides all other controls.
STOP (Standby)	STOP pushbutton	POWER STOP	RECORD DRIVE FAST FWD REWIND	All tape motion will stop within three seconds. NOTE When changing to the REPRODUCE mode from either the a) RECORD, b) FAST FORWARD, or c) REWIND modes, the STOP must be depressed first in addition to the appropriate pushbutton.

CHAPTER FOUR

CHECKOUT AND ALIGNMENT

4.1 GENERAL

4.2 The procedures outlined in this chapter are used as a performance check of the system to ensure operation within the specifications shown in the Description and Specifications chapter of this instruction manual. All checks should be performed after an extensive corrective maintenance operations, after shipment of the system, or whenever the system has been dismantled and reassembled. In addition, many of the procedures outlined in this chapter can be used in calibrating the system prior to a data gathering run. For best results, use test equipment equivalent to that specified. The accuracy of the system can be no greater than the accuracy of the instruments used to align it.

4.3 The specifications and test procedures assume the use of AMPEX magnetic tape. Use of other tape types may produce slightly different frequency response and output characteristics. Unless otherwise specified, all tape should be bulk-erased before use, and the heads should be demagnetized.

4.4 TEST EQUIPMENT REQUIREMENTS. The following test equipment or its equivalent, is required to perform checkout and alignment procedures outlined in this chapter. The Test Equipment Chart, Table 4-1, lists the equipment which is required for a specific group of test procedures, according to the system being used.

4.5 USE OF TEST PANEL

4.6 The test panel (see figure 4-1) contains fuses for power input, transport power and electronics power. Test jacks are provided for checking the voltage output of each power supply. The Primary Power Supply is checked between the 28V jack and ground. The Electronics Power Supply is checked between the +12V jack and ground and between the -12V jack and ground. The Capstan Drive Inverter output is measured between the CAPSTAN jacks.

4.7 The TEST switch energizes the RECORD relay without the DRIVE pushbutton being pressed. Regulated +12 volts d-c are supplied to the Record Amplifiers through the

contacts K1 when the TEST switch is closed. The BIAS DISABLE switch removes the bias signal from the Record Amplifier by removing the -12 volts from the Master Bias Oscillator.

Table 4-1. Test Equipment Chart

TEST EQUIPMENT	DIRECT SYSTEM	FM SYSTEM	PDM SYSTEM	CONTROL TRACK GENERATOR
Counter, Hewlett Packard 523B		X*		
Digital Voltmeter, Non-linear Systems 481		X*		
Filter SKL 302	X			
Oscillator, Audio, Hewlett Packard 200CD	X	X*		X
Oscilloscope				X
Oscilloscope, Tektronix 545A w/Type CA Dual Trace Preamplifier			X	
Pulse Generator, Tektronix 161			X	
VTVM A-C, Hewlett Packard 400D	X			X
Wave Analyzer, Donner 2102	X			

* Not required if AMPEX TC-10 is used for FM System

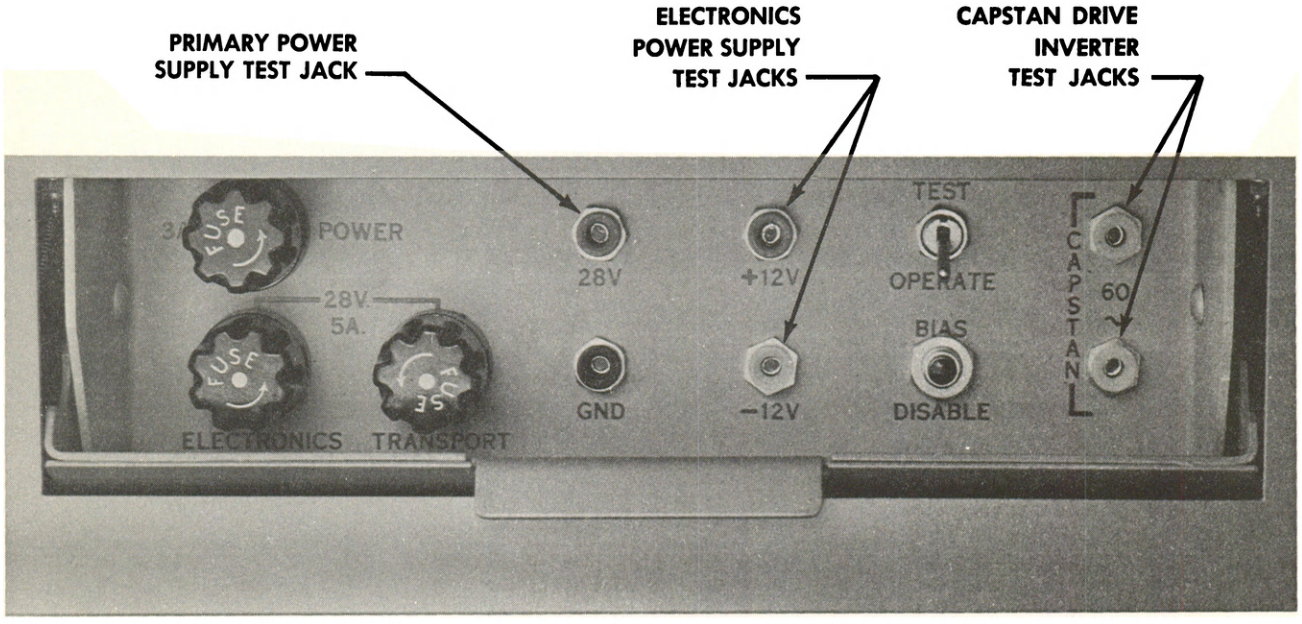


Figure 4-1. Test Panel

4.8 CHECKOUT OF POWER INPUTS

4.9 Before placing the equipment in operation for a data-gathering run or performing the alignment procedures for the system electronics, the following voltages should be checked and verified at the Test Panel.

(a) 28 volts d-c

(b) +12 volts d-c

(c) -12 volts d-c

(d) 115 volts a-c

Step 1: Apply power to the equipment.

Step 2: Using a suitable voltmeter connected between the 28V jack and GND jack, observe that the voltage reading is 28 volts ±2 volts dc (factory-set at 28 volts).

Step 3: Connect a digital voltmeter across the +12V and GND jacks and observe that the voltage reading is +12 volts ±0.2% (+11.976 to +12.024 volts).

Step 4: Connect the digital voltmeter across the -12V and GND jacks and observe that the voltage reading is -12 volts ±0.2% (-11.976 to -12.024 volts).

Step 5: Connect the a-c voltmeter across the white CAPSTAN 60 CPS jacks and observe that the voltage reading is 115 volts ±5% (110 to 120 volts a-c), with the capstan at speed.

Step 6: If no further tests are to be performed, remove power from the system and remove test equipment.

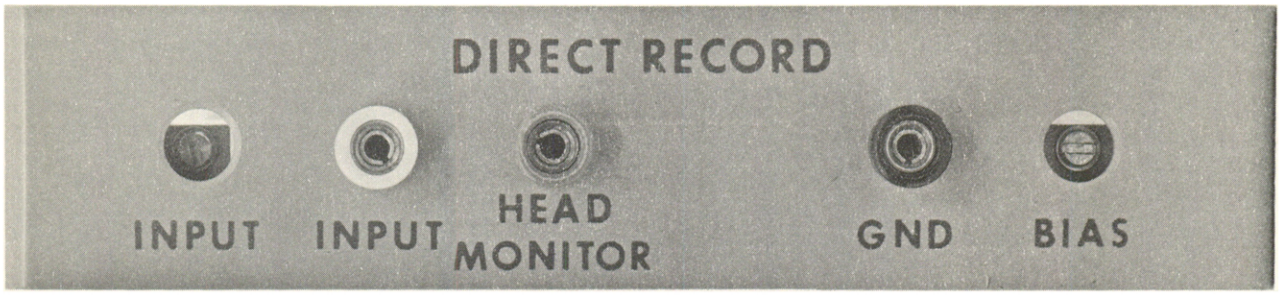
NOTE

Prior to checkout and alignment the heads should be cleaned and demagnetized in accordance with Section 6.36 of Chapter Six.

4.10 DIRECT SYSTEM ALIGNMENT

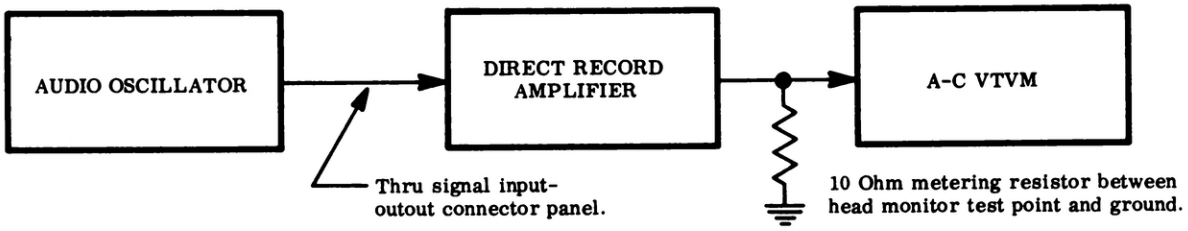
4.11 DIRECT RECORD AMPLIFIER BIAS LEVEL ADJUSTMENT

Step 1: Connect a VTVM between the HEAD MONITOR and GROUND test points located on the front panel of the direct record amplifier (see figure 4-2) being checked.



8437-1

Figure 4-2. Typical Front Panel, Direct Record Amplifier



50952

Figure 4-3. Test Set-up, Record Level Adjustment

Step 2: Apply power to the system.

Step 3: Remove the signal input to the direct record channel being checked.

Step 4: Place the TEST/OPERATE switch, in the recessed control panel, in the TEST position.

Step 5: Observe that the VTVM reading is 18 ma (180 mv as measured by the VTVM across a 10-ohm resistor). If necessary adjust the BIAS CONTROL on the front panel of the amplifier to achieve this reading.

Step 6: Repeat Steps 3 thru 5 above for the remaining direct record amplifiers.

4.12 DIRECT RECORD AMPLIFIER RECORD LEVEL ADJUSTMENT

Step 1: Connect the test equipment as shown in figure 4-3.

Step 2: Adjust the oscillator output at 1.0 volt rms at 1000 cps.

Step 3: Place the TEST/OPERATE switch in the recessed control panel in the TEST position.

Step 4: Hold the BIAS switch depressed, in the recessed control panel, in the DISABLE position.

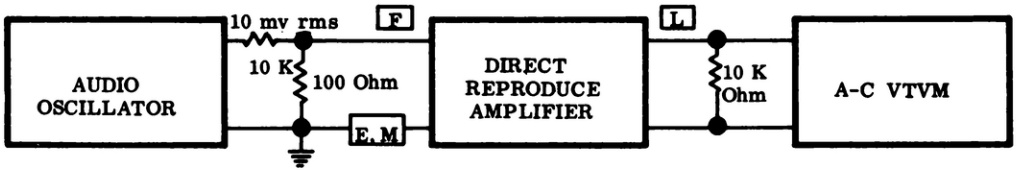
Step 5: Check that the VTVM reading is 1.5 ma (15 mv on the VTVM). Adjust the RECORD LEVEL control with the appropriate attenuator on the front panel of the record amplifier being checked.

Step 6: Repeat Steps 2 thru 5 above for the remaining record amplifiers.

Step 7: Return the TEST/OPERATE switch to its OPERATE position.

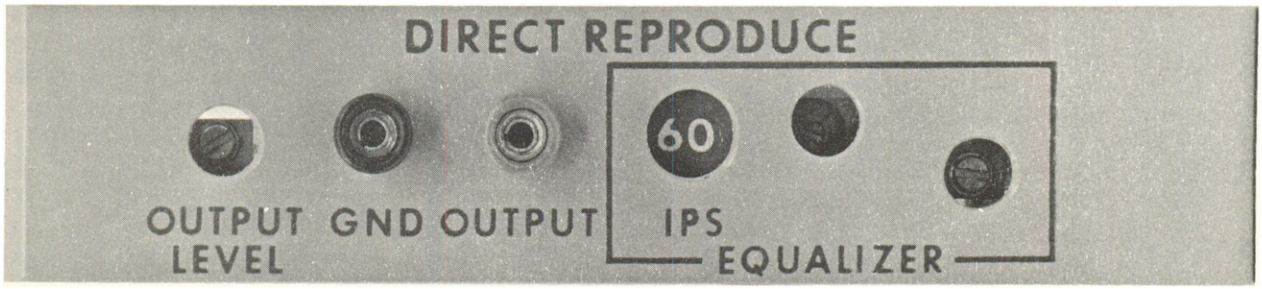
4.13 AMPLITUDE EQUALIZER ADJUSTMENTS

4.14 The direct reproduce amplifiers can be interchanged within the system without realignment, but this is not recommended as a normal operating procedure. Reproduce equalizer adjustments are normally set for optimum performance with the reproduce heads for a specific track. If amplifiers are interchanged, some change in frequency response may be expected. This change is largely confined to the upper end of the passband, and in most applications is not of sufficient magnitude to affect the data being recorded.



50953

Figure 4-4. Test Set-up, Static Equalizer Adjustment



8437-3

Figure 4-5. Typical Front Panel, Direct Reproduce Amplifier

4.15 STATIC EQUALIZER ADJUSTMENT

Step 1: Connect the amplifier to the card rack through an extension card, and connect the test equipment as shown in figure 4-4. Turn power ON.

NOTE

To protect the preamplifiers, either remove them or capacitively couple the input signal.

Step 2: Supply the input of the amplifier with a 10-millivolt rms signal at 500 cps through the 40 db pad, by setting the oscillator to 1 volt rms.

Step 3: Adjust the amplifier **OUTPUT LEVEL** control, on the face of the reproduce amplifier (see figure 4-5) to obtain a -10 dbm reading on the VTVM.

Step 4: Adjust the oscillator to the frequency of the plug-in equalizers as shown in Table 4-2.

Step 5: Maintaining the 1-volt signal level, adjust the appropriate control on the plug-in equalizer to obtain the indicated meter reading. (Refer to Chapter Five, Theory of Operation, of this manual to determine which are the appropriate controls.)

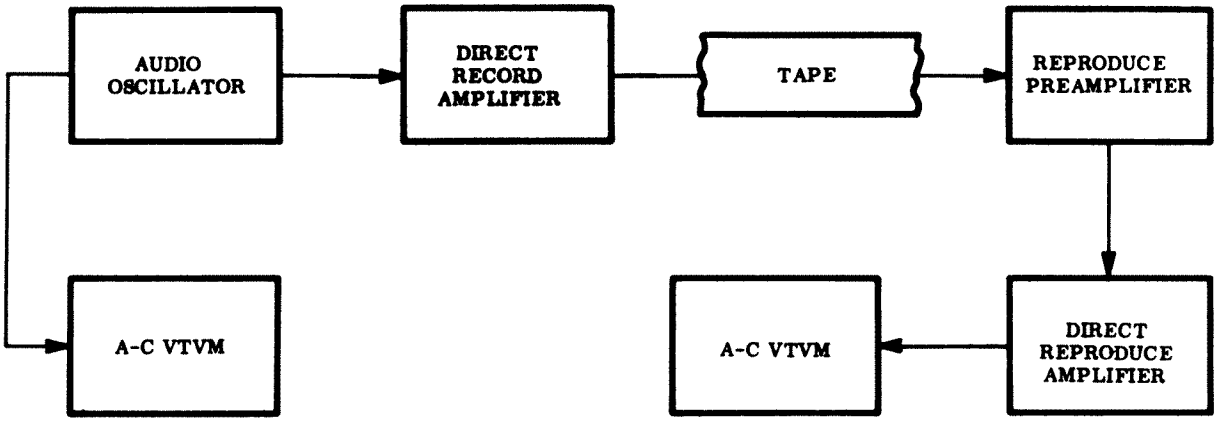
Step 6: Repeat the procedure for all remaining amplifiers and equalizers.

Table 4-2. Static Equalizer Adjustment Frequencies

SPEED	60 IPS			30 IPS			15 IPS		
Frequency (in kc)	0.5	100	240	0.5	50	120	0.5	25	60
Output Level (db)	-10	-29.5	-14	-10	-27	-13	-10	-23.5	-9
SPEED	7-1/2 IPS			3-3/4 IPS			1-7/8 IPS		
Frequency (in kc)	0.5	12.5	30	0.5	6.25	14	0.5	3.1	7
Output Level (db)	-10	-18.5	-5	-10	-13	-3.5	-10	-10	-2

NOTE

The amplifiers and equalizers are now adjusted for normal response. Due to variations in head response and tape, especially in the high frequency end, the curves may not apply in all cases. For optimum equalization of the direct reproduce amplifiers, the procedures described in the following paragraphs should be used.



50954

Figure 4-6. Test Set-up, Amplitude Equalizer Adjustment

4.16 ADJUSTMENT FOR 7-1/2, 15, 30, AND 60 IPS SPEEDS

Step 1: Connect the test equipment as shown in figure 4-6.

Step 2: Align the Direct Record System (Sections 4.11 and 4.12).

NOTE

If a reproduce-only system is used, a test tape must be prepared in advance on a correctly aligned record system.

Step 3: Change the belt combination if necessary, and set the TAPE SPEED selector switch, on the transport, to the desired operational tape speed. Place the system in the RECORD mode.

Step 4: Set the oscillator at 500 cps at normal record input level.

Step 5: Set the OUTPUT LEVEL control of the direct reproduce amplifier at some convenient level such as: 0 db.

Step 6: Set the oscillator to the 2nd frequency shown in Table 4-3, and adjust L1 until a resonance or highest level is obtained.

Step 7: If the resonance point is below the second frequency level, turn inductor L1 adjustment counterclockwise. If a resonance point still cannot be obtained, turn potentiometer R3, counterclockwise.

Step 8: When resonance point is obtained at the 2nd frequency, adjust potentiometer R3, clockwise until the output level, at the resonance point, is 0 db.

Step 9: Set the oscillator to the 1st frequency shown in Table 4-3, and adjust inductor L1 until 0 db output level is obtained. If the output level is -db, turn L1 adjustment clockwise; and if the output level is +db, turn L1 adjustment counterclockwise.

Step 10: Sweep the oscillator over the designated passband of the desired speed to ensure the response is within specification (see figure 4-7).

Step 11: Repeat Steps 1 through 10 for the remaining amplifiers and equalizers.

4.17 ADJUSTMENT FOR 3-3/4 AND 1-7/8 IPS SPEEDS

Step 1: Connect the test equipment as shown in figure 4-6.

Step 2: Align the Direct Record System (Sections 4.11 and 4.12).

NOTE

If a reproduce-only system is used, a test tape must be prepared in advance on a correctly aligned record system.

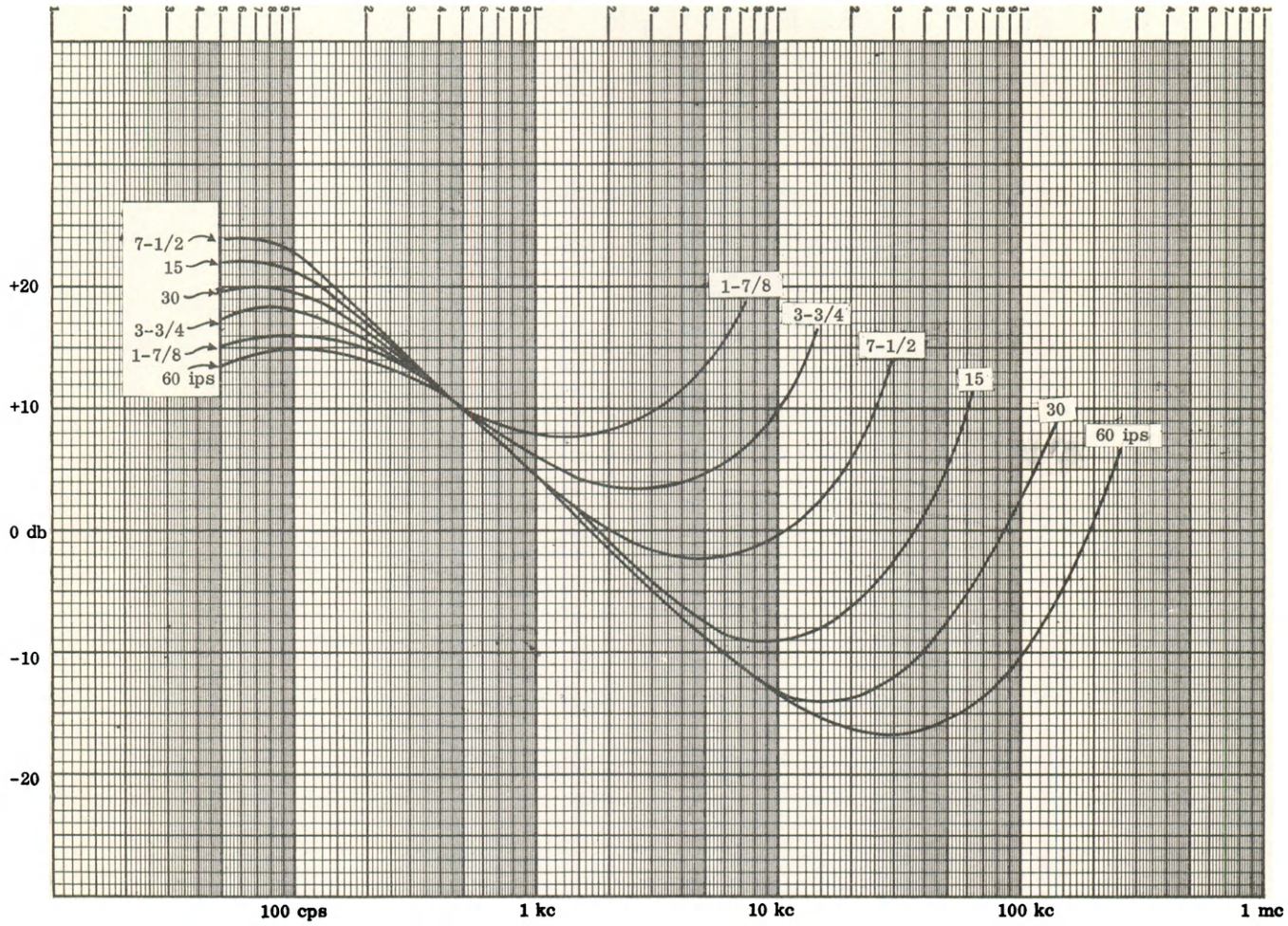


Figure 4-7. Direct Reproduce Amplifier Equalization Curves Wideband

50955

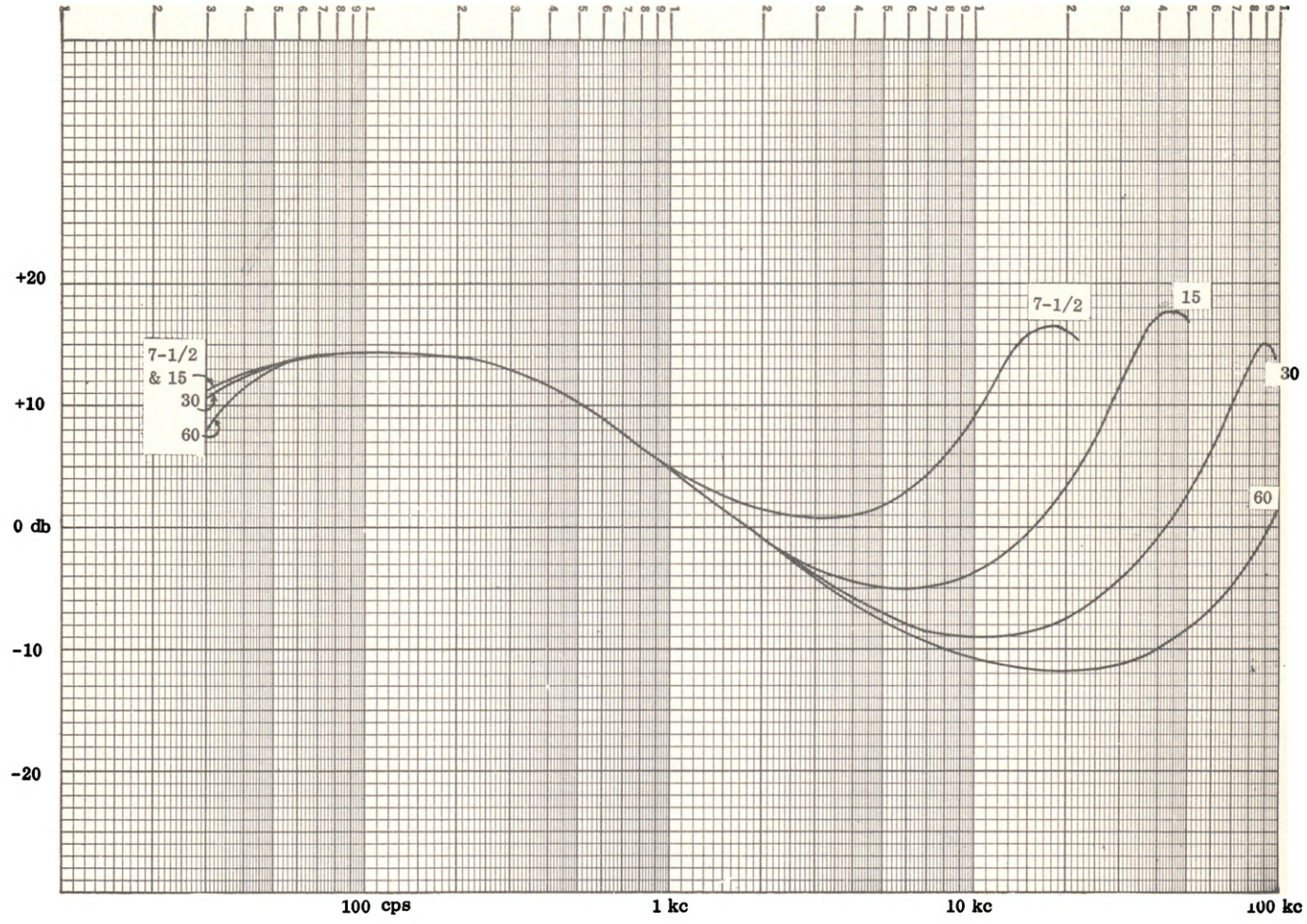


Figure 4-8. Direct Reproduce Amplifier Equalization Curves Standard Bandwidth

50956

Table 4-3. Equalizer Alignment Frequencies
(Wideband)

Tape Speed (ips)	1st Frequency (kc)	2nd Frequency (kc)	3rd Frequency (kc)
60	100	240	250
30	50	120	125
15	25	60	62.5
7-1/2	12.5	30	31.3
3-3/4	6.25	15	15.6
1-7/8	3.13	7.5	7.8

Table 4-4. Equalizer Alignment Frequencies
(Standard)

Tape Speed (ips)	1st Frequency (kc)	2nd Frequency (kc)	3rd Frequency (kc)
60	40	100	125
30	20	50	62.5
15	10	25	31.3
7-1/2	5	12.5	15.5
3-3/4	2.5	6.25	7.81
1-7/8 <	1.25	3.13	3.91

Step 3: Set the TAPE SPEED selector switch, on the transport, to the desired operational tape speed. Place the system in the RECORD mode.

Step 4: Set the oscillator at 500 cps, at a normal record input level.

Step 5: Set the output of the direct reproduce system at some convenient level, such as 1.0 volt rms or 0 db.

Step 6: Reset the oscillator to the first or lower frequency (see Tables 4-3 and 4-4, Equalizer Alignment Frequencies) corresponding to the operational tape speed selected. The level at this frequency should be the same as that for the 500 cps reference point. Adjust the equalizer control corresponding to the frequency set on the oscillator until the output of the direct reproduce module is the same as that for the 500 cps reference point. Refer to figures 4-7 and 4-8.

Step 7: Reset the oscillator to the second or higher frequency, corresponding to the same tape speed selected in Step 3. Adjust the equalizer control corresponding to this higher frequency until the output level of the direct reproduce amplifier is again the same as that for the 500 cps reference point.

Step 8: Reset the oscillator to the third or top frequency making it correspond to the operational tape speed selected previously. The level at this frequency should be the same as that for the 500 cps reference point. The response should remain within specifications.

4.18 PHASE EQUALIZER GAIN ADJUSTMENT

NOTE

The following adjustment procedure will be needed only when parts have been replaced.

Step 1: Set up the test equipment as shown for making amplitude equalizer adjustments.

Step 2: Set the TAPE SPEED SELECTOR switch, on the transport, to the desired operational tape speed. Place the system in the RECORD mode.

Step 3: Set the oscillator output at 500 cps.

Step 4: With the amplitude equalizer inserted in the reproduce amplifier, connect a 100 uf capacitor across C2. The negative side of the capacitor must be toward connector "C" of the amplitude equalizer.

Step 5: Adjust control R14 so that the output level shows no change when the capacitor is alternately removed from and replaced across C2.

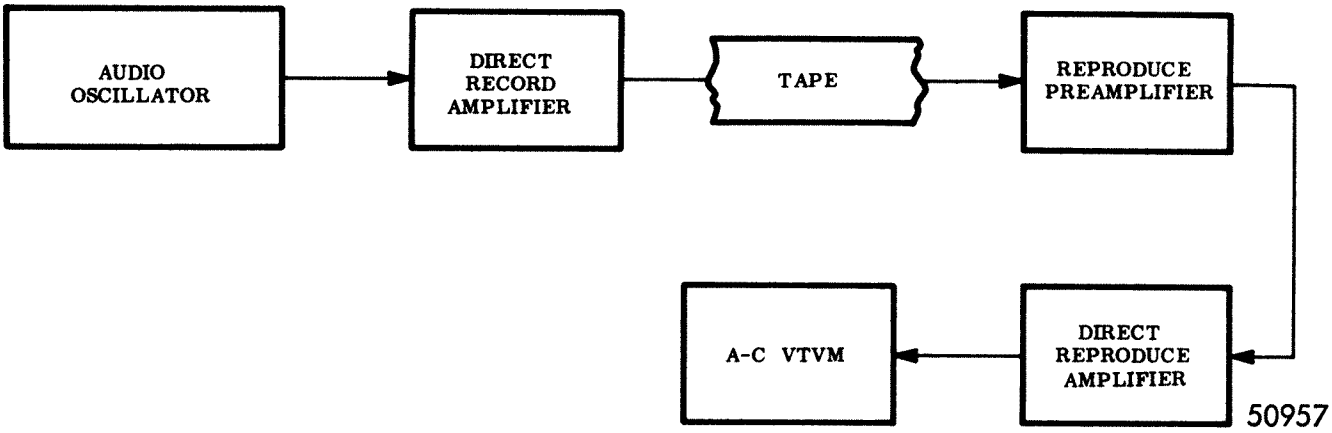


Figure 4-9. Test Set-up, Reproduce Level Adjustment and Frequency Response Check

4.19 REPRODUCE LEVEL ADJUSTMENT

4.20 The reproduce level adjustment is made with the OUTPUT LEVEL attenuator on the face of the reproduce amplifier to provide a convenient output for the system.

Step 1: Connect the test equipment as shown in figure 4-9.

Step 2: Prepare a test tape at 500 cps at a normal signal input level with a correctly aligned direct record amplifier.

Step 3: Using the test tape as a reference, adjust the OUTPUT LEVEL attenuator on the face of the reproduce amplifier for the desired output level (nominally 1.0 volt rms).

4.21 DIRECT SYSTEM PERFORMANCE CHECKS

4.22 **FREQUENCY RESPONSE CHECK.** A frequency response check is an excellent overall performance test of the direct Record/Reproduce system. It also provides an excellent test of direct reproduce amplifier amplitude equalization adjustment.

Step 1: Connect the test equipment as shown in figure 4-9.

Step 2: Align the Direct Record System (Sections 4.11 and 4.12).

Step 3: Align the Direct Reproduce System (Sections 4.13 thru 4.19).

Step 4: At a tape speed of 60 ips, prepare a test tape with a 500 cps reference level frequency, recorded at normal input signal level. Sweep the oscillator through

the passband of the direct system. The input level must remain constant throughout the sweep.

Step 5: Reproduce the test tape. The output level should meet the frequency response specifications listed in Chapter One. In the event of a peak in the upper mid-range of the frequency response, adjust L1 on -10, -20, 30, and 40 equalizers or R4 on 50 and 60 equalizers to lower the peak. To correct for a discrepancy occuring in the upper 20% of the frequency passband, adjust R3.

Step 6: Repeat Steps 4 and 5 for all other tape speeds.

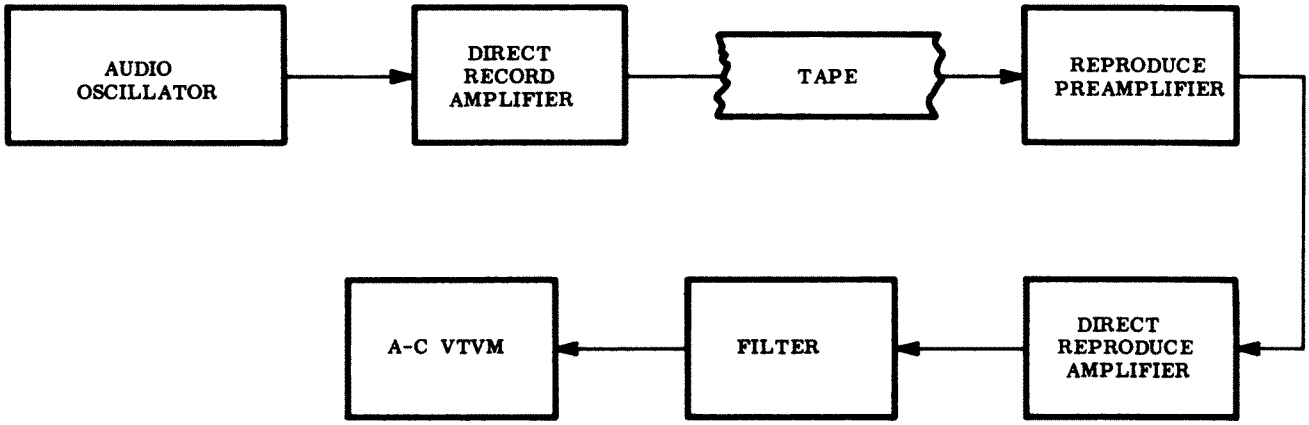


Figure 4-10. Test Set-up, Signal-to-Noise Check

4.23 SIGNAL-TO-NOISE RATIO CHECK

Step 1: Align the Direct Record System (Sections 4.11 and 4.12).

Step 2: Align the Direct Reproduce System (Sections 4.13 thru 4.19).

Step 3: Connect the test equipment as shown in figure 4-10.

Step 4: Adjust the oscillator for a 500 cps signal at normal input level.

Step 5: Set the transport TAPE SPEED control at 60 ips and insert a 46330-01 (60 ips) equalizer in the direct reproduce module.

Step 6: Adjust the filter for a passband of 300 cps to 200 kc.

NOTE

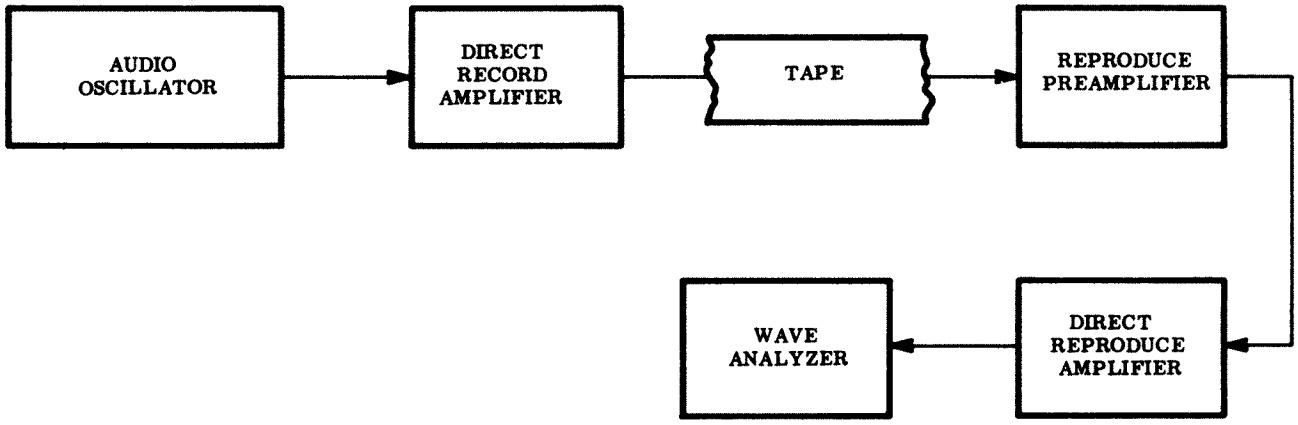
The filter should be checked for insertion loss or gain, and appropriate correction made to the signal -to-noise ratio measurements. In addition, the signal-to-noise ratio of the filter must be considered in the final computations.

Step 7: Record a strip of tape with the 500 cps signal without changing any other conditions. Remove the input signal and continue recording for an additional period.

Step 8: Reproduce the data. Log the rms noise in db below the output reference level. Compare the system noise with the specifications shown in Chapter One, Description and Specifications, of this instruction manual.

NOTE

The tape must be recorded, then reproduced, to achieve meaningful results in this test. Failure to meet signal-to-noise specifications may be associated with a faulty reproduce preamplifier. This condition may be checked by interchanging preamplifier cards.



50959

Figure 4-11. Test Set-up, Distortion Check

4.24 DISTORTION CHECK

Step 1: Align the Direct Record System (Sections 4.11 and 4.12).

Step 2: Align the Direct Reproduce System (Sections 4.13 thru 4.19).

Step 3: With a reel of bulk-erased tape on the transport, connect the test equipment as shown in figure 4-11.

NOTE

Use of incompletely or improperly erased tape will affect the accuracy of this test.

Step 4: Adjust the oscillator for an output of 500 cps at normal signal level.

Step 5: While simultaneously recording and reproducing the input signal, measure and log the percentage of 3rd harmonic (1500 cps) content in the output of the system.

Step 6: The second harmonic distortion should be checked. If excessively high distortion is present (greater than 0.8%) the head should be demagnetized.

4.25 CONTROL TRACK GENERATOR (CTG). The following adjustment procedures are required prior to operating the Control Track Generator and are to be performed in the sequence presented.

4.26 BIAS LEVEL ADJUSTMENT. To perform bias level adjustments refer to Section 4.11.

4.27 RECORD LEVEL ADJUSTMENT

Step 1: Set the "CTG OUT" (potentiometer (R36)) fully counterclockwise (required only if data is to be recorded on the control track).

Step 2: Perform the adjustment procedures given in Section 4.13.

4.28 CONTROL TRACK GENERATOR LEVEL ADJUSTMENT

Step 1: Connect the oscilloscope vertical input between the "CTG OUT" (TP6) and 2 GND (TP3) test points.

Step 2: Adjust the "CTG OUT" potentiometer (R36) for a 5 volt peak-to-peak voltage display on the oscilloscope.

Step 3: Adjust the "CTG IN" potentiometer (R26) to obtain 50 percent modulation of the signal displayed on the oscilloscope.

Step 4: If necessary, readjust the "CTG OUT" potentiometer (R36) for a 5 volt peak-to-peak oscilloscope display.

Figure 4-12. Typical Front Panel, FM Record Amplifier

4.29 FM RECORD/REPRODUCE SYSTEM PERFORMANCE CHECKS

4.30 The FM record/reproduce system may be aligned with standard laboratory equipment or with the portable AMPEX TC-10 FM Test Unit. The following alignment procedures give complete instructions using either method.

4.31 ALIGNMENT OF FM RECORD AMPLIFIER USING AMPEX TC-10 CALIBRATION UNIT

4.32 For optimum performance, the FM record amplifier must be aligned prior to starting any new data gathering run or whenever a new tape speed is selected. The following equipment is required to align the FM record amplifier by means of the Ampex TC-10 Calibration Unit. The amplifier is assumed to be in place and operating in a complete system. Equipment required:

1) Ampex TC-10 Calibration Unit with cable set.

2) Screwdriver with 1/8 inch blade.

4.33 Before beginning the calibration and alignment procedure, check the output of the

electronics power supply at the +12 volt and -12 volt jacks on the recessed test panel. A digital voltmeter must read +12 volts ±0.2% and -12 volts ±0.2%. If the voltages do not fall within the tolerance specified, refer to Chapter Six, Maintenance, of this manual for proper adjustment procedures. With the power supply voltages as specified, proceed as follows:

Step 1: Remove the FM record amplifier. Rotate speed select switch S1 to the desired tape speed. Then replace the amplifier in its receptacle.

Step 2: Connect the RECORD DC and RECORD AC receptacles on the AMPEX TC-10 to the INPUT and HEAD MON. jacks, respectively, on the front panel of the amplifier.

Step 3: Set the operating controls of the AMPEX TC-10 to the following positions:

Mode	Record
Center Carrier Frequency	See table 4-5
% Deviation Frequency	0
% Deviation Voltage	0
Modulation Range	Off

Step 4: Adjust the Carrier Frequency control on the front panel of the record amplifier until a zero beat is obtained. As proper adjustment is neared, the tone becomes a series of clicks, evenly dying away as the center frequency is approached. In addition, an error signal may also be observed on the Frequency Difference meter. The error signal is indicated by a perceptible oscillation of the meter needle as a zero beat is neared.

Step 5: Reset the operating controls of the AMPEX TC-10 to the following positions:

% Deviation Frequency	-40
% Deviation Voltage	40
Range and Polarity	- 2
Non-Linearity	0

Step 6: Adjust the Working Voltage control for a "0" reading on the voltage difference meter.

Step 7: Adjust the Coarse and Fine deviation controls on the front panel of the record amplifier for a zero beat in the loudspeaker or a zero indication on the frequency difference meter.

Table 4-5 FM Operating Frequencies

Tape Speed (ips)	Center Carrier Frequency (KC)	Deviated Frequency (KC) +40%	Deviated Frequency (KC) +30%	Deviated Frequency (KC) -40%	± Deviation (KC) 40%	± Deviation (KC) 30%
WIDE BAND						
60	108.	151.2	140.4	64.8	±43.2	±32.4
30	54.	75.6	70.2	32.4	±21.6	±16.2
15	27.	37.8	35.1	16.2	±10.8	± 8.1
7-1/2	13.5	18.9	17.55	8.1	± 5.4	± 4.05
3-3/4	6.75	9.45	8.775	4.05	± 2.7	± 2.025
1-7/8	3.375	4.725	4.3875	2.025	± 1.35	± 1.0126
NARROW BAND						
60	54	75.6	70.2	32.4	±21.6	±16.2
30	27	37.8	35.1	16.2	±10.8	± 8.1
15	13.5	18.9	17.55	8.1	± 5.4	± 4.05
7-1/2	6.75	9.45	8.775	4.05	± 2.7	± 2.025
3-3/4	3.375	4.725	4.3875	2.025	± 1.35	± 1.0125
1-7/8	1.687	2.362	2.1931	1.012	± .675	± .5061

Step 8: Reset the operating controls of the TC-10 to the following positions:

% Deviation Frequency	+40
Range and Polarity	+ 2

Step 9: Adjust the Working Voltage control for a zero indication from the loudspeaker or a zero indication on the frequency difference meter.

Step 10: Adjust the Non-Linearity control for a zero reading on the voltage difference meter and observe the amount and direction of non-linearity. The Non-Linearity control is calibrated directly in units of percentage of bandwidth.

Step 11: Reset the operating controls of the TC-10 to the following positions:

% Deviation Frequency	+30
% Deviation Voltage	30

Step 12: Adjust Working Voltage control for a zero indication from the loudspeaker or a zero indication on the frequency difference meter.

Step 13: Adjust the Non-Linearity control for a zero reading on the voltage difference meter and observe the amount and direction of non-linearity. The amount of non-linearity should be approximately the same as that given in Step 10, but in the opposite direction.

NOTE

If the readings obtained in Steps 10 and 13 are not within the specified tolerance, perform Steps 14 thru 17.

Step 14: Set the Non-Linearity control half-way between the readings observed in Steps 10 and 13.

Step 15: Reset the operating controls of the TC-10 as follows:

% Deviation Frequency	-40
% Deviation Voltage	40
Range and Polarity	- 2

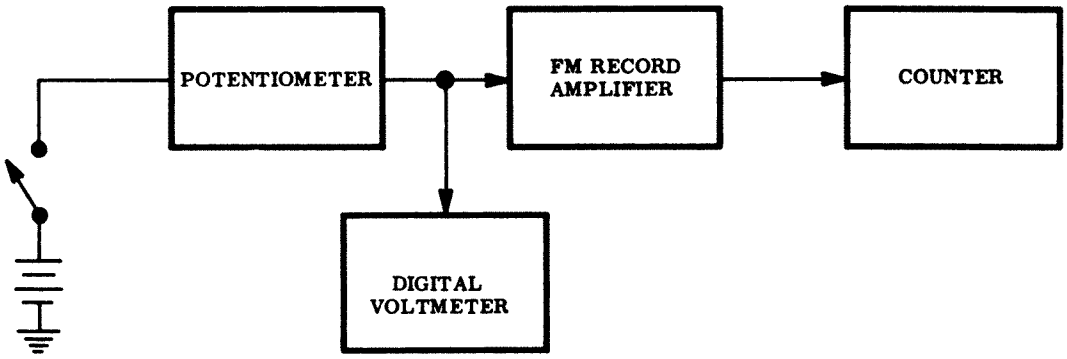
Step 16: Adjust the Working Voltage control for a zero reading on the voltage difference meter.

Step 17: Adjust the Coarse and Fine deviation controls on the front of the amplifier card for a zero beat.

4.34 ALIGNMENT OF FM RECORD AMPLIFIER USING STANDARD LABORATORY INSTRUMENTS

4.35 The following equipment is required to align the FM record amplifier with standard laboratory instruments. Equipment required:

1) Digital Voltmeter, Non-Linear Systems Model 481 (or equivalent)
2) Counter, Hewlett-Packard Model 523B (or equivalent)
3) Voltage Divider Network (potentiometer)
4) Dry Cell Battery, 1.5 volt



50960

Figure 4-13. Test Set-up, FM Record Amplifier

NOTE

The adjustment instructions given below assume a full ±40% deviation for a 1-volt rms sine wave input. If desired, the FM record amplifier may be adjusted to produce a ±40% deviation with an input voltage greater or less than 1.0 volt rms. The FM record system may be adjusted to produce full frequency deviation with as little as 0.5 volt rms.

Step 1: Check the output of the electronic power supply by connecting the digital voltmeter to the labeled test points located on the recessed test panel. The output should be +12 volts ±0.2% and -12 volts ±0.2%.

Step 2: Remove the FM record amplifier. Rotate speed select switch S1 to the desired tape speed. Then replace the amplifier in its receptacle.

Step 3: Connect the equipment as shown in Figure 4-13. The input is connected to the INPUT jack on the amplifier card front panel. The output of the amplifier is available at the HEAD MON jack, which is also on the front panel.

Step 4: Observe the center carrier frequency shown on the counter. The frequency must correspond with the selected carrier frequency as shown in table 4-5. Set the FREQ ADJ control on the amplifier card front panel to obtain this reading.

Step 5: Connect the battery input to the FM record amplifier and adjust the voltage divider for -1.414 volts d-c input, as measured with the digital voltmeter.

NOTE

If the system is to be aligned to produce ±40% deviations with inputs greater or less than 1.0 volt rms sine wave, the desired peak voltage, (rms times 1.414) should be used in place of the 1.414 volts indicated in step 5.

Step 6: Observe the deviated frequency shown on the counter. The frequency must correspond to the figure shown in table 4-5 for -40% deviation. Set the COARSE and FINE DEVIATION ADJ controls on the record amplifier front panel to achieve this reading.

Step 7: Reverse the battery polarity, making certain that the voltage is not changed. Read the frequency shown on the counter and compare this frequency with the +40 column in table 4-5. Observe the amount and direction of error.

Step 8: Reset the voltage for 75% of the d-c voltage given in step 6 (1.060 volts dc). Read the frequency shown on the counter and compare this frequency with the +30 column in table 4-5. Observe the amount and direction of error.

NOTE

The errors observed in steps 7 and 8 should be approximately equal in magnitude, but in opposite directions. If these errors are not within specification or a greater accuracy is desired, perform Steps 9 and 10.

Step 9: Determine the amount and direction of the difference in the errors obtained from Steps 7 and 8.

Step 10: Connect the battery for the same polarity and voltage as used in Step 5. Reset the COARSE and FINE DEVIATION ADJ controls to obtain an error that is equal to one half the difference observed in Step 9, but in the opposite direction.

4.35A FM RECORD AMPLIFIER - SERVICE ALIGNMENT

NOTE

Service alignment shall be attempted only by a qualified technician or an authorized AMPEX Service Engineer.

4.35B Service alignment of the FM record amplifier must be performed during routine calibration or whenever a component has been replaced. If an AMPEX TC-10 Calibration unit is available, use the procedure that starts from paragraph 4.35C. If the TC-10 is not available, use the procedure that starts from paragraph 4.35E. Assemble the required equipment and establish initial control settings on the FM record amplifier as specified in this paragraph before starting either procedure.

Equipment Required:

1) AMPEX TC-10 Calibration Unit or standard laboratory equipment consisting of an adjustable source of d-c voltage, a device capable of measuring this voltage with 0.01% accuracy, and a switch to short-circuit or open-circuit the amplifier INPUT jack to the GND jack.

2) Counter, Hewlett-Packard Model 523B (or equivalent).

3) Board Extender Card, Ampex Catalog No. 46382.

4) The CP-100 Electronics Power Supply (left installed in the Recorder/Reproducer), set to provide positive and negative output voltages that are within the range from 11.988 to 12.012 volts. A digital voltmeter, Non-Linear Systems Model 481, or equivalent, may be used to calibrate these voltages.

5) Thermostatically-controlled oven capable of operating within the range from 25 to 60 degrees centigrade.

6) Suitable connecting cables.

Initial Settings (see figure 4-13A)

1) Speed Select switch S1 to 60.

2) FREQ ADJ control on amplifier front panel to mid-range.

3) COARSE DEVIATION ADJ control on front panel 1/4-turn clockwise.

4) FINE DEVIATION ADJ control on front panel to mid-range.

5) Bias Null Adjustment R4A 1/4-turn clockwise.

6) Temperature Compensation Adjustment R4B fully counterclockwise.

7) Linearity Adjustment R4D fully counterclockwise.

4.35C SERVICE ALIGNMENT OF FM RECORD AMPLIFIER USING AMPEX TC-10 CALIBRATION UNIT.

4.35D After establishing initial control settings on the FM record amplifier as specified in paragraph 4.35B, energize the CP-100 to apply power to the electronics circuits and proceed as follows:

Step 1: Plug the extension board into the printed circuit receptacle for the FM record amplifier and plug the amplifier into the extension board receptacle.

Step 2: Connect the counter across the HEAD MON. and GND jacks on the record amplifier front panel. Connect the INPUT jack on the amplifier front panel to the REPRODUCE DC receptacle on the TC-10.

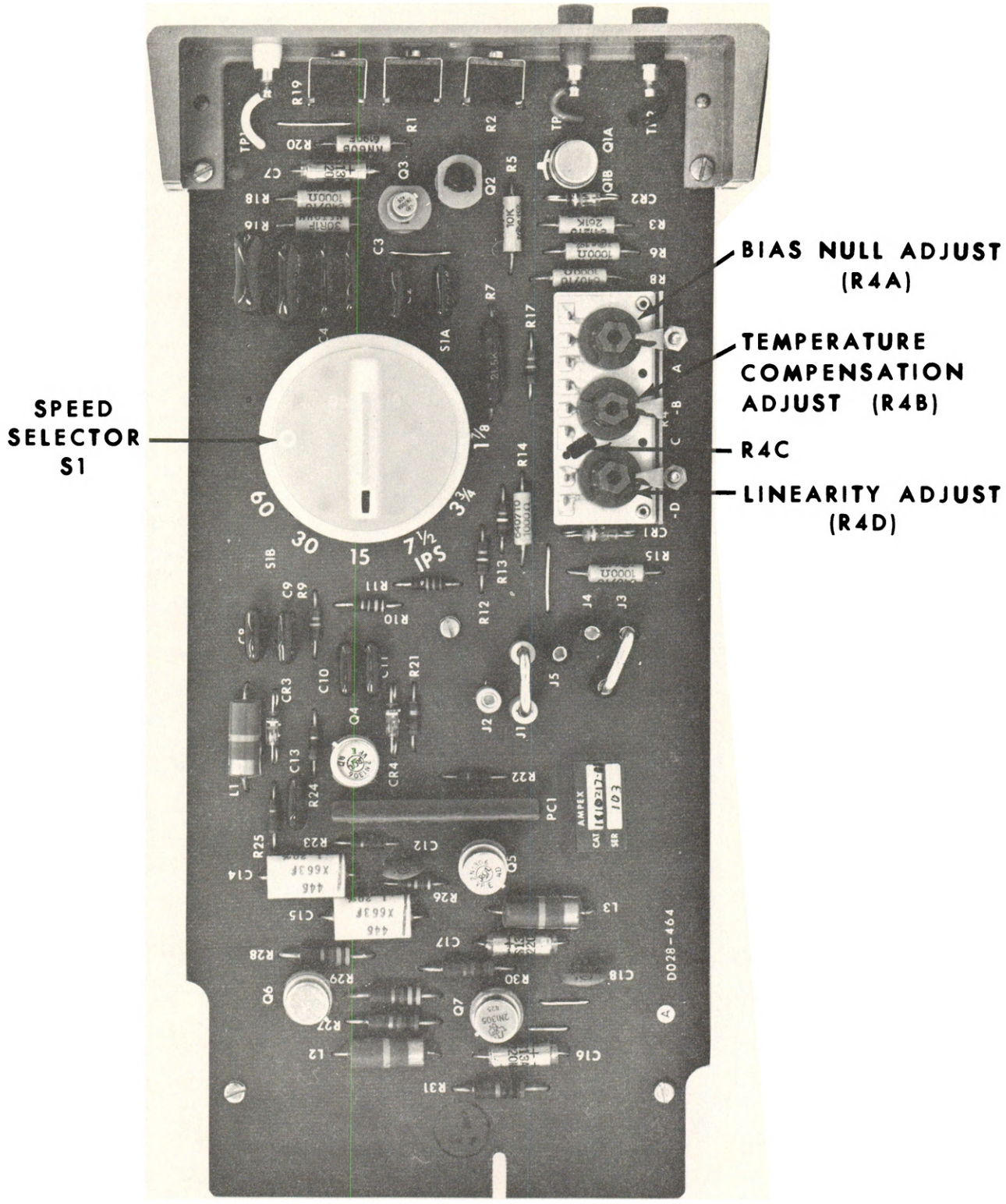


Figure 4-13A. FM Record Amplifier - Service Alignment Controls

Step 3: Set the operating controls of the TC-10 to the following positions:

Operating Mode - Record
% Deviation Voltage - "0"
(The Voltage Difference meter is now a very sensitive zero-center galvanometer.)

Step 4: Set Bias Null Adjustment R4A for zero reading on the Voltage Difference meter.

Step 5: Connect the amplifier INPUT to the RECORD DC receptacle on the TC-10.

Step 6: Reset the Operating Mode to Record.

Step 7: Set the % Deviation control to "0" and note the frequency indication on the counter.

Step 8: Disconnect the amplifier and place it in the oven for 1/2 hour at 60° Centigrade.

Step 9: Remove the amplifier from the oven and reconnect it as before. Again note the frequency indication on the counter. Subtract this indication from the indication observed in Step 7 to determine the amount of drift. Designate this frequency difference as drift number 1.

Step 10: While the amplifier is still at 60° Centigrade, rotate Temperature Compensation Adjustment R4B fully clockwise and note the frequency indication on the counter.

Step 11: Allow the amplifier to return to room temperature and note the new frequency indication. Subtract this indication from that obtained in Step 10, to determine the amount of drift. Designate this difference as drift number 2.

Step 12: The total drift compensation is the sum of drifts 1 and 2. The desired drift compensation ratio is equal to drift number 1 divided by the sum of drifts 1 and 2. Set Temperature Compensation Adjustment R4B to approximately this ratio of its total resistance. Then repeat Steps 2 through 4 to reset the Bias Null Adjustment before proceeding with Step 13.

Step 13: Repeat Step 5. Then verify that adjustment of the FREQ ADJ control on the amplifier front panel will shift the center carrier frequency throughout the range from

105 to 111 kc. If necessary to achieve this range, shift the jumper connection across resistors R14 and R15 to J3, J4, or J5. If the jumper connection is shifted, repeat Steps 2 through 4 to reset the Bias Null Adjustment and repeat this step before proceeding with Step 14.

Step 14: Set the FREQ ADJ control for 108.000 kc center carrier frequency, as indicated on the counter.

Step 15: Set the TC-10 operating controls as follows:

% Deviation Voltage	40
Polarity	- (negative)
Working Voltage	"0" (indicated on Voltage Difference Meter)

Step 16: Set the COARSE and FINE DEVIATION ADJ controls to obtain a carrier frequency of 64.800 kc, indicated on the counter.

Step 17: Reset the TC-10 operating controls as follows:

Polarity	+ (positive)
Working Voltage	"0" (indicated on Voltage Difference Meter)

Step 18: Set the Linearity Adjustment control, R4D, to obtain a carrier frequency of 151.050 kc, to assure a minimum average linearity error.

NOTE

The preceding adjustments may be performed at any of the tape speeds. The range of the FREQ ADJ control will be less than 3 kc at the lower carrier frequencies used for the slower tape speeds.

4.35E SERVICE ALIGNMENT OF FM RECORD AMPLIFIER USING STANDARD LABORATORY EQUIPMENT.

4.35F After establishing initial control settings on the FM record amplifier as specified in paragraph 4.35B, proceed as follows:

Step 1: Install the extension board in the printed circuit receptacle for the FM record amplifier and plug the amplifier into the extension board receptacle.

Step 2: Connect the switch across the INPUT and GRD jacks and the counter across the HEAD MON. and GRD jacks on the amplifier front panel. (See figure 4-13B.) Leave d-c voltage source disconnected.

Step 3: Set Bias Null Adjust control R4A so that no change in carrier frequency (indicated on the counter) occurs when the amplifier INPUT is alternately shorted and opened by means of the switch.

Step 4: Leave the input shorted and note the carrier frequency.

Step 5: Disconnect the amplifier and place it in the oven for 1/2 hour at 60° Centigrade.

Step 6: Remove the amplifier from the oven and reconnect it as before. Again note the carrier frequency. Subtract this frequency from that obtained in Step 4 to determine the amount of drift. Designate this frequency difference as drift number 1.

Step 7: While the amplifier is still at 60° Centigrade, rotate Temperature Compensation Adjustment R4B fully clockwise and note the carrier frequency indication on the counter.

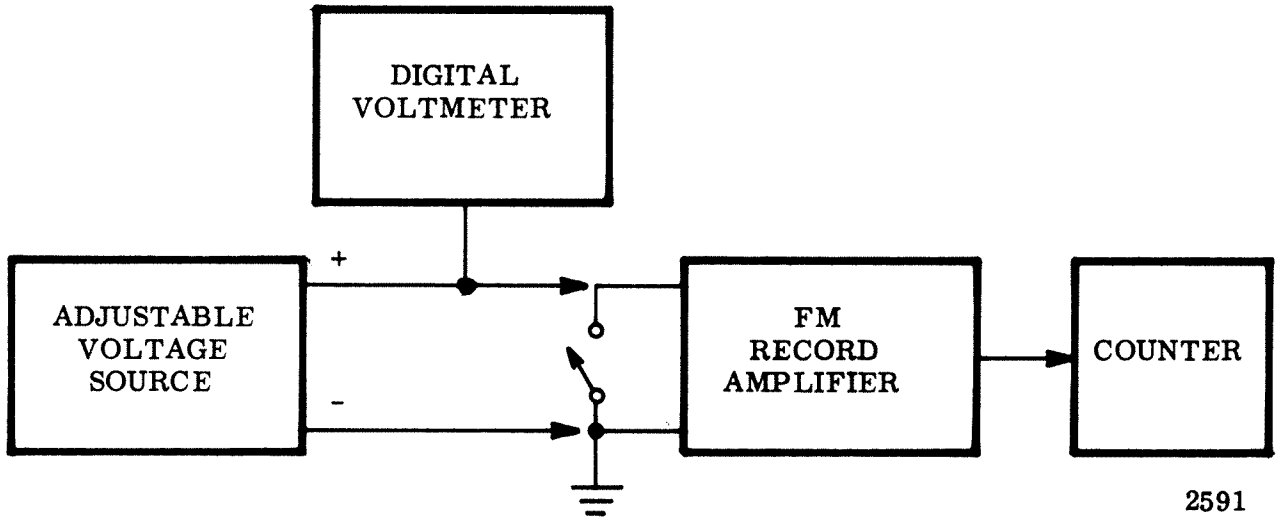


Figure 4-13B Standard Test Equipment Setup for FM Record Amplifier Service Alignment

Step 8: Allow the amplifier to return to room temperature and note the new carrier frequency. Subtract this frequency from that obtained in Step 7 to determine the amount of drift. Designate this frequency difference as drift number 2.

Step 9: The total drift compensation is the sum of drifts 1 and 2. The desired drift compensation ratio is equal to drift number 1 divided by the sum of drifts 1 and 2. Set Temperature Compensation Adjustment R4B to approximately this ratio of its total resistance. Then repeat Step 3 to reset the Bias Null Adjustment before proceeding with Step 10.

Step 10: With the switch, short the input. Then verify that adjustment of the FREQ ADJ control will shift the center carrier frequency throughout the range from 105 to 111 kc. If necessary to achieve this range, shift the jumper connection across resistors R14 and R15 to J3, J4, or J5. If the jumper connection is shifted, repeat Step 3 to reset the Bias Null Adjustment and repeat this Step before proceeding with Step 11.

Step 11: Set the FREQ ADJ control for 108.000 kc center carrier frequency, as indicated on the counter.

Step 12: Apply a negative voltage to the amplifier INPUT (unshorted by the switch) that is approximately the value of a full-scale input signal (factory tests are made at 1.414 volts) and carefully set the COARSE and FINE DEVIATION ADJ controls to obtain a carrier frequency of 64.800 kc.

Step 13: Reverse the polarity of the input voltage without changing its value. Set Linearity Adjustment R4D to obtain a carrier frequency of 151.050 kc to assure a minimum average linearity error.

Step 14: Linearity at intermediate points may be checked by applying to the amplifier INPUT known fractions of the original signal and noting the difference between actual and calculated carrier frequencies.

NOTE

The preceding adjustments and linearity checks may be performed at any of the tape speeds. The range of the FREQ ADJ control will be less than 3 kc at the lower carrier frequencies used for the slower tape speeds.

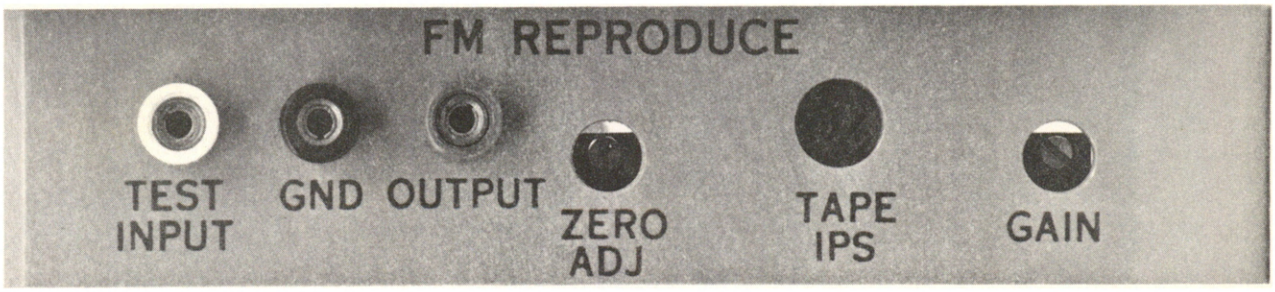


Figure 4-14 Typical Front Panel FM Reproduce Amplifier

4.36 ALIGNMENT OF FM REPRODUCE AMPLIFIER USING AMPEX TC-10 CALIBRATION UNIT

4.37 For optimum performance the FM reproduce amplifier should be aligned whenever a plug-in filter unit has been replaced or changed. (The procedure assumes the amplifier to be operating in a complete system.) The following equipment is required to align the FM reproduce amplifier:

1) AMPEX TC-10 FM Calibration Unit with Cable Set.
2) Screwdriver with 1/8-inch blade.

Step 1: Connect the REP AC receptacle on the TC-10 to TP1, TEST INPUT on the FM reproduce amplifier (see figure 4-14). Connect the REP DC receptacle on the TC-10 to TP2 (OUTPUT jack) on the front panel. The normal output load of the FM reproduce amplifier system must either be connected or simulated (10,000 ohms).

Step 2: Plug in the filter unit for the tape speed to be used.

Step 3: Set the operating controls of the TC-10 to the following positions:

MODE:	REPRODUCE
CENTER CARRIER FREQUENCY:	See Table 4-6
% DEVIATION FREQUENCY	0
% DEVIATION VOLTAGE	0
MODULATION RANGE	OFF

Step 4: Adjust the ZERO ADJ. control on the front panel of the FM reproduce amplifier for a zero indication of the VOLTAGE DIFFERENCE meter. Use the HI position of the SENSITIVITY switch for maximum accuracy.

Step 5: Reset the operating controls of the TC-10 to the following positions:

% DEVIATION FREQUENCY	+40
% DEVIATION VOLTAGE	40
RANGE AND POLARITY	+2.0
NONLINEARITY	0

Step 6: Adjust the GAIN control on the FM reproduce amplifier for a zero indication on the VOLTAGE DIFFERENCE meter.

Table 4-6. FM Operating Frequencies

TAPE SPEED (ips)	CENTER CARRIER FREQUENCY (kc)	+40% DEVIATION FREQUENCY (kc)	-40% DEVIATED FREQUENCY (kc)	+DEVIATION (kc)
WIDE BAND				
60	108	151.2	64.8	± 43.2
30	54	75.6	32.4	± 21.6
15	27	37.8	16.2	± 10.8
7-1/2	13.5	18.9	8.1	± 5.4
3-3/4	6.75	9.45	4.05	± 2.7
1-7/8	3.38	4.73	2.03	± 1.35
NARROW BAND				
60	54	75.6	32.4	± 21.6
30	27	37.8	16.2	± 10.8
15	13.5	18.9	8.1	± 5.4
7-1/2	6.75	9.54	4.05	± 2.7
3-3/4	3.38	4.73	2.03	± 1.35
1-7/8	1.69	2.36	1.01	± .675

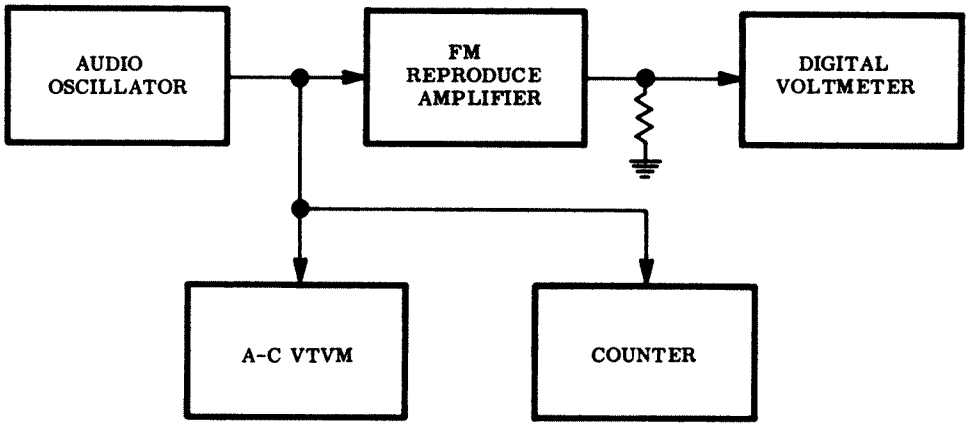
Step 7: Reset the operating controls of the TC-10 to the following positions:

% DEVIATION FREQUENCY	-40
% DEVIATION VOLTAGE	40
RANGE AND POLARITY	- 2.0
NONLINEARITY	0

Step 8: Adjust the NONLINEARITY control for a zero indication on the VOLTAGE DIFFERENCE meter. The NONLINEARITY control reads directly in percentage of full band voltage. If the reading is within specifications, no further adjustment is required. If the reading is not within specifications or if greater accuracy is required, the following steps should be taken:

Step 9: Set the NONLINEARITY control halfway between its present setting and zero. Readjust the GAIN control on the reproduce amplifier for a zero indication on the VOLTAGE DIFFERENCE meter.

Step 10: Recheck the +40% deviation as in Step 5.



50961

Figure 4-15. Test Set-up, Alignment of FM Reproduce Amplifier

4.38 ALIGNMENT OF FM REPRODUCE AMPLIFIER USING STANDARD LABORATORY INSTRUMENTS

4.39 The procedure assumes that the amplifier is operating in a complete system. The following equipment is required to align the FM reproduce amplifier using standard laboratory instruments:

1) Audio Oscillator
2) Digital Voltmeter
3) Counter
4) A-c VTVM
5) Plug-in Extension Card

Step 1: Check the output of the electronics power supply with the digital voltmeter at the +12 V and -12 V jacks located in the recessed test panel. The output should be +12 volts ±0.2% and -12 volts ±0.2%.

Step 2: Connect the equipment as shown in figure 4-15. Insert an extension card between the reproduce amplifier and the card rack. The normal output load of the FM reproduce system must be either connected or simulated.

CAUTION

REMOVE THE PREAMPLIFIERS TO PREVENT DAMAGING THEM.

Step 3: Plug in the filter unit for the tape speed to be used.

Step 4: Connect the oscillator output to pin **F** of the extension card. Set the oscillator frequency at the center frequency corresponding to the tape speed, as shown in Table 4-6. The output level of the oscillator should be adjusted to 250 millivolts.

Step 5: Adjust the ZERO ADJ control on the front panel of the reproduce amplifier for a 0 volt d-c output.

Step 6: Readjust the oscillator frequency to the +40% deviation frequency shown in Table 4-6. Adjust the GAIN control on the front panel of the reproduce amplifier for a +1.414 volts d-c output.

Step 7: Readjust the oscillator frequency to the -40% deviation frequency shown in Table 4-6. Adjust the GAIN control for minimum error in the +40% and -40% deviation outputs. With the input frequency to the amplifier deviated -40%, the output of the amplifier should be -1.414 volts d-c.

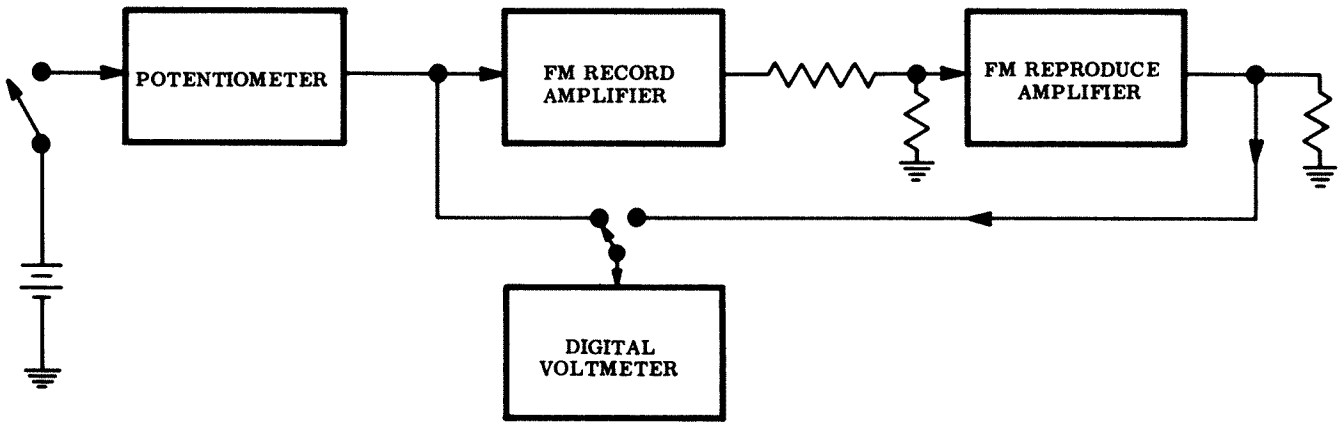
4.40 ALIGNMENT OF FM REPRODUCE AMPLIFIER USING LABORATORY INSTRUMENTS AND PRE-ALIGNED FM RECORD AMPLIFIER

4.41 The procedure assumes that the amplifier is operating in a complete system. The following equipment is required to align the **FM** reproduce amplifier using laboratory instruments and a pre-aligned **FM** record amplifier:

1) Correctly aligned **FM** Record Amplifier
2) Digital Voltmeter
3) Potentiometer
4) Battery, 1.5 volts
5) Plug-in Extension Card

CAUTION

REMOVE PREAMPLIFIERS TO PREVENT DAMAGE TO THEIR OUTPUT TRANSISTORS.



50962

Figure 4-16. Test Set-up, Using Calibrated FM Record Amplifier for Alignment of FM Reproduce Amplifier

Step 1: Connect the test equipment and FM record amplifier as shown in figure 4-16. Plug an extension card between the reproduce amplifier and the card rack. The output of the FM record amplifier should be jumpered from the HEAD MONITOR test point on the front panel of the record amplifier, through an attenuator, to pin F of the extension card.

Step 2: Disconnect the input to the FM record amplifier. The digital voltmeter now reads the output voltage of the FM reproduce amplifier, which should be 0 volt d-c ±1 mv. Adjust the ZERO ADJ control to achieve this reading.

Step 3: Connect the battery as shown and, using the digital voltmeter, adjust the input to the FM record amplifier to +1.414 volts.

Step 4: Using the digital voltmeter, check the output of the FM reproduce amplifier, which should read +1.414 volts d-c. Adjust the GAIN control on the reproduce amplifier front panel to achieve this reading.

Step 5: Reverse the polarity of the input to the FM record amplifier, making sure that the voltage does not change. Read the voltage output of the FM reproduce amplifier, which should read -1.414 volts d-c. Adjust the GAIN control on the front panel for a minimum error in the +1.414 and -1.414 volts readings.

4.42 DRIFT CHECK

4.43 When the FM reproduce module has been properly aligned, drift can be checked in the following manner.

Step 1: Connect a stable frequency input to TEST INPUT jack.

Step 2: Monitor the d-c output at the OUTPUT jack on the front panel of the reproduce amplifier.

NOTE

If the AMPEX TC-10 FM Calibration unit is used to check drift, the test must be made around the +10% or -10% frequency deviations. Drift around zero deviation cannot be measured with the NONLINEARITY control of the TC-10.

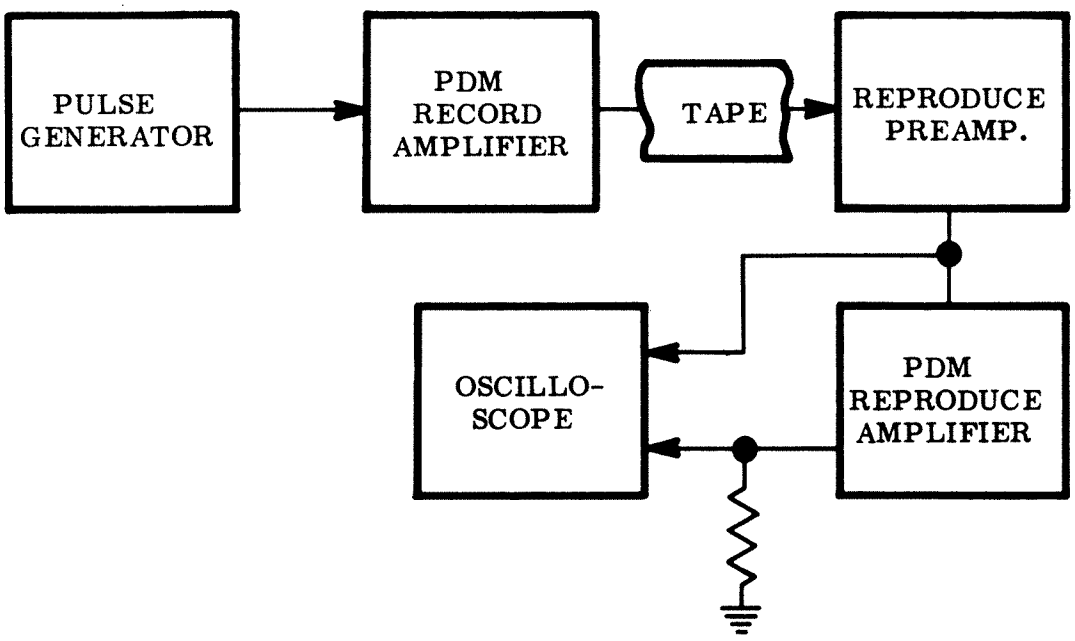


Figure 4-17. Test Set-up PDM Reproduce Amplifier

4.44 PDM SYSTEM ADJUSTMENT PROCEDURES*

Step 1: Connect the test equipment as shown in Figure 4-17.

* These procedures performed at Ampex Corporation using a Tektronix Oscilloscope Model 545A and Dual Trace Preamplifier Type CA.

NOTE

An extension card is required for access to adjustment controls on the record and reproduce modules.

Step 2: Set tape speed to 30 ips so that sufficient recording time is available.

NOTE

The jumper plugs on both the PDM record and reproduce modules should be in the 0° position. The locations of the jumper plugs are shown in Figure 4-18. Jumper plug connections are summarized in Table 4-7.

NOTE

If a new system is being checked out, omit the following (Step 3), since the pulse return is already factory-set for 2,500 microseconds.

Step 3: Set the PULSE RETURN adjustment control R25 on the PDM reproduce to fully clockwise and place the P4 jumper plug in the "A B" position.

Step 4: Set up a 100-microsecond positive pulse with an 1100-microsecond period on the pulse generator and adjust the level to 20 volts zero-to-peak.

Step 5: Connect the output of the pulse generator to the input of the CP-100. Adjust the INPUT ADJ. control R1 of the PDM record amplifier (see figure 4-19) to give 1.0 volt zero-to-peak at the INPUT test jack on the record amplifier module.

Step 5A: Adjust head current as follows:

a. Place TEST/OPERATE switch in TEST position.

b. Connect scope probe to HD MON test jack on PDM record module front panel.

c. Set Head Current Adjust (R37) for 0.35 volt peak-to-peak waveform (17.5 milliamperes peak head current, positive and negative).

d. Return TEST/OPERATE switch to OPERATE position.

Step 6: Connect the inputs to the oscilloscope dual trace preamplifier as follows:

a. INPUT test jack of PDM Reproduce Amplifier (see figure 4-19) to "A" at 0.2 v/cm.

b. OUTPUT test jack of PDM Reproduce Amplifier to "B" at 10 v/cm.

c. Connect "B" input to time base "B" trigger input.

NOTE

Both inputs to the dual trace preamplifier should be a-c coupled.

Step 7: Set Oscilloscope Time Base "A" controls as follows:

a. (+) internal a-c.

b. Stability control fully clockwise.

c. Time base 20 microsecond/CM calibrated.

Step 8: Set Oscilloscope Time Base "B" controls as follows:

a. (+) external a-c.

b. Stability and Trigger level as necessary.

c. Time Base 0.2 millisecond/CM calibrated.

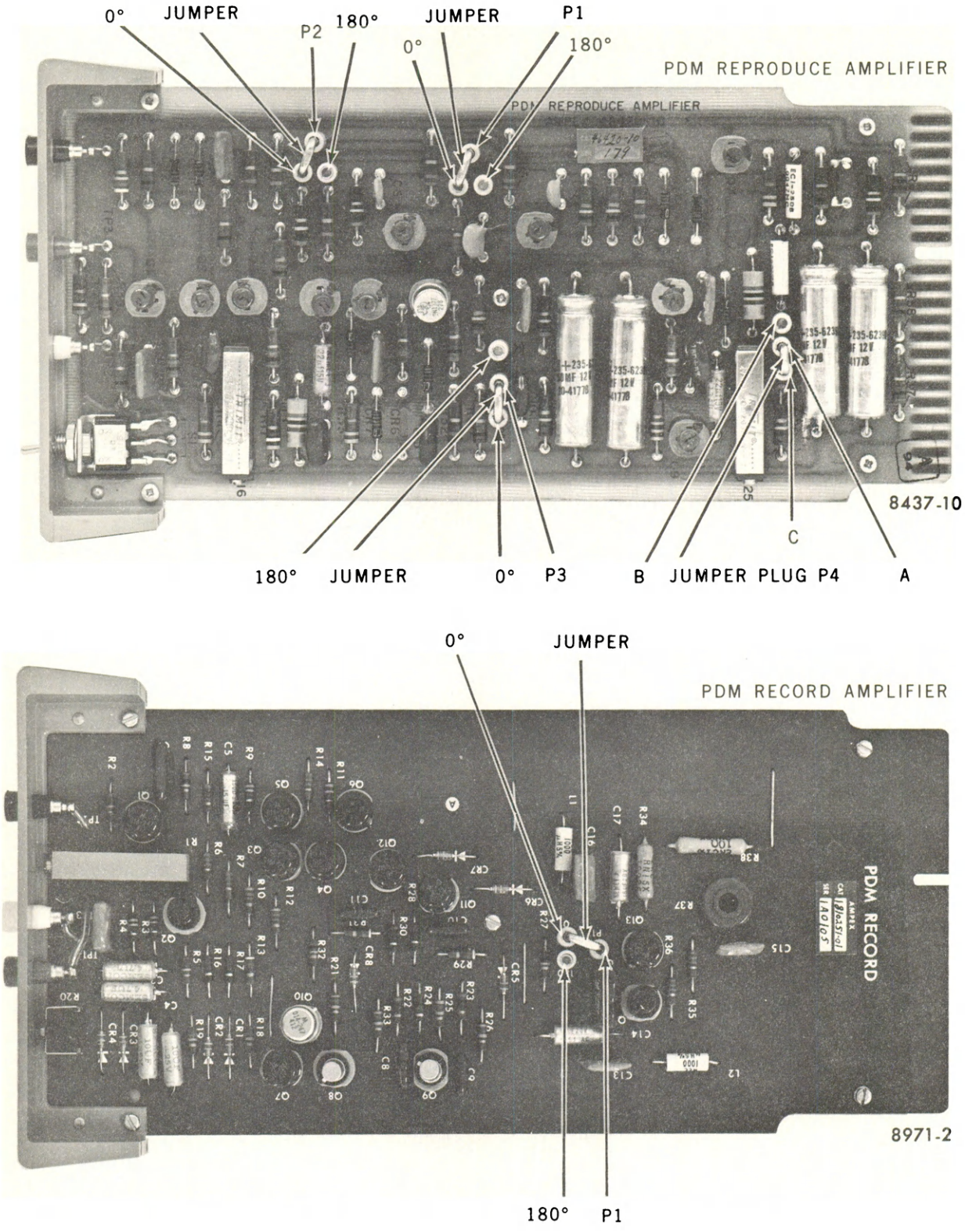
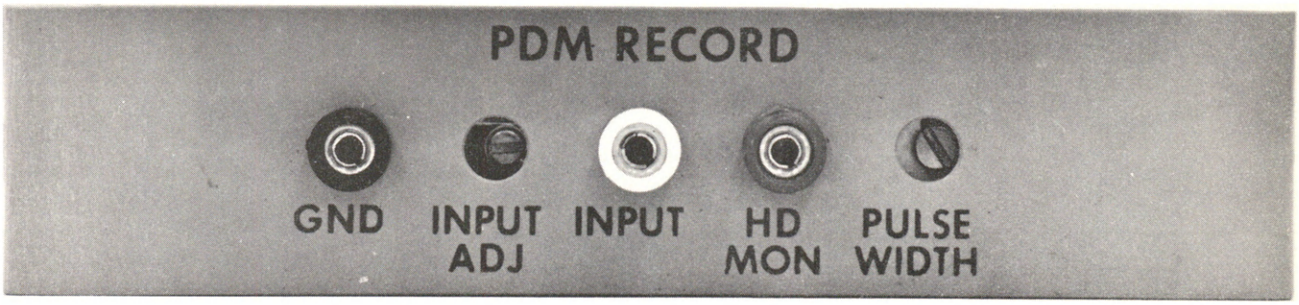


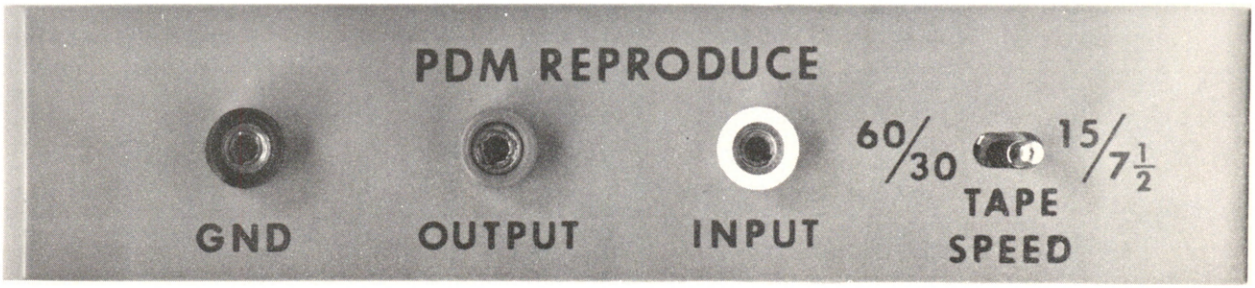
Figure 4-18. PDM Jumper Plug Locations

Table 4-7. PDM Module Jumper Plug Input-Output Configurations

PDM REPRODUCE MODULE					PDM RECORD MODULE		
INPUT POLARITY	P1	P2	P3	OUTPUT POLARITY	INPUT POLARITY	P1	OUTPUT POLARITY
+	0°	0°	0°	+	+	0°	+
+	0°	180°	180°	-	+	180°	-
-	180°	180°	0°	+	-	180°	+
-	180°	0°	180°	-	-	0°	-



8971-1



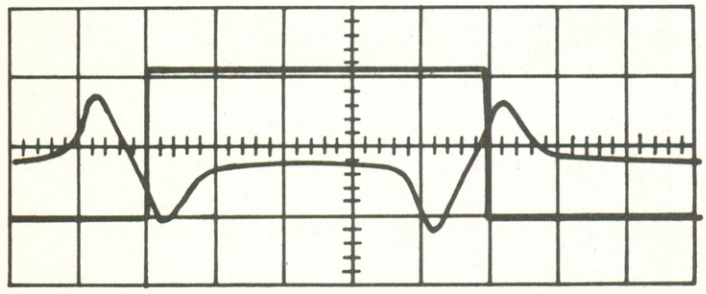
8437-11

Figure 4-19 PDM Record and Reproduce Amplifier Front Panels

Step 9: Horizontal display is "B" intensified by "A". If the intensity is not too great, an intensified spot should appear somewhere on the trace. The spot can be moved by adjusting the delay time multiplier. (The intensified spot is that portion of the trace that will be presented on the scope when the horizontal display is moved to "A" delayed by "B").

Step 10: Place CP-100 in RECORD mode and adjust time base "B" stability and trigger level for stable trace on "alternate sweep" mode.

Step 11: Switch the horizontal display to "A" delayed by "B". By changing the Delay-Time Multiplier position, observe the rise and fall times of output pulses and where they occur in relation to the input waveform. Adjust R16 on the reproduce amplifier, if necessary, so that the rise and fall times of the output pulse are symmetrical about (equidistant to) the zero crossing point of the input waveform (see figure 4-20).



LEGEND

1. Speed - 30 ips
2. Time divisions - 20μsec/cm
3. Output Pulse - 10 v/cm
4. Input Waveform - .1 v/cm

50966

Figure 4-20. Typical Waveform depicting the rise and fall time of the output pulses in relation to the input waveform

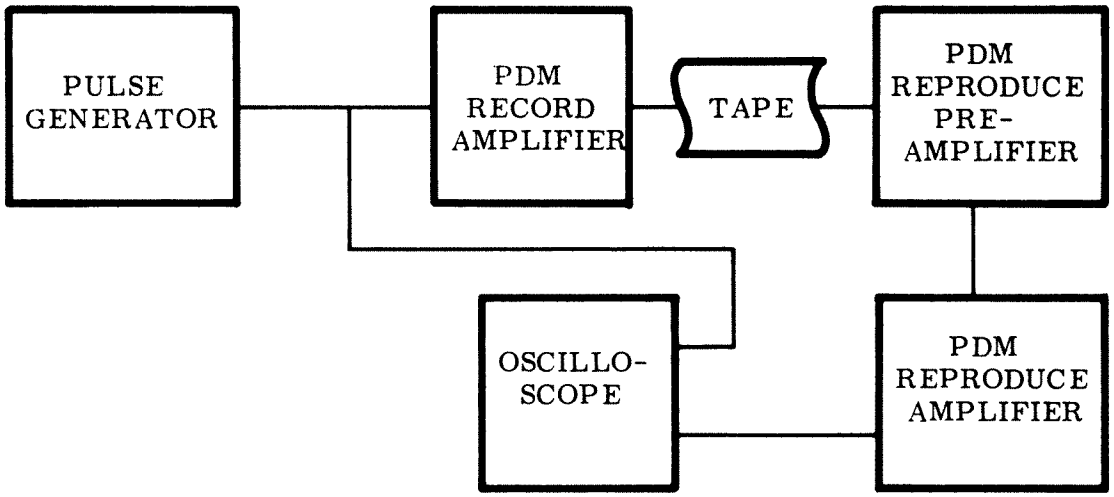
Step 12: Place the CP-100 in the STOP mode.

Step 13: Connect test equipment as shown in figure 4-21.

Step 14: Connect the input to the oscilloscope dual trace preamplifier as follows:

a. INPUT test jack of PDM Record Amplifier to "A" at .5 v/cm.

Step 15: Set up a 500-microsecond positive pulse with an 1100-microsecond period on the pulse generator, making certain not to move the pulse amplitude control.



50967

Figure 4-21. Test Set-up PDM Record Amplifier

Step 16: Set the Oscilloscope Time Base "A" control as follows:

a. Time base 2 microsecond/cm calibrated.

Step 17: Set the Oscilloscope Time Base "B" controls as follows:

a. (+) internal a.c.

Step 18: Horizontal display is "B" intensified by "A".

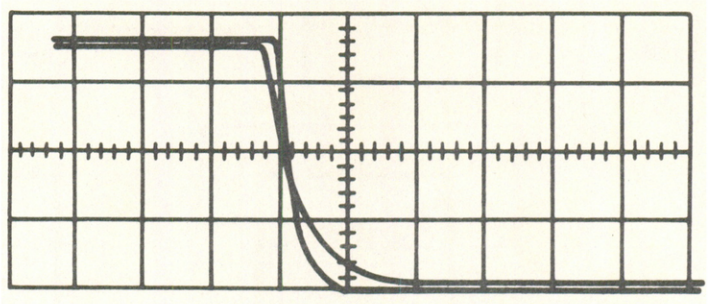
Step 19: Disconnect the "B" external trigger.

Step 20: Place the mode selector on the dual trace preamplifier to "A" only and adjust the time base "B" stability and trigger level so that the trace trigger at 50% of its rise time (+0.5 volt).

NOTE

If the pulse width is changed, the trigger level must be adjusted for proper triggering at the 50% point.

Step 21: Place the CP-100 in the RECORD mode, and the mode selector switch on the dual trace preamplifier to alternate sweep. Adjust the vertical position controls so that the two traces are superimposed on each other (see figure 4-22).



50968

Figure 4-22. Typical Waveform depicting the fall times of the input compared to the PDM reproduce output. (Rise times triggered at 50% points) 30 ips

Step 22: Using the delay time multiplier, move the intensified spot so that it covers the fall times of both traces. Place the horizontal display to "A" delayed by "B" and adjust R20 on the record amplifier (use extension card) so that the 50% points coincides in time.

Step 23: Adjust the pulse generator for a 50-microsecond pulse and adjust the trigger and vertical position controls so that the traces coincide. Observe the fall times. The error must be less than ±2 microseconds.

Step 24: Adjust the pulse generator for a 950-microsecond pulse and adjust the trigger and vertical position controls so that the traces coincide. Observe the fall times. The error must be less than ±2 microseconds.

Step 25: If the fall time error is greater than ±2 microseconds at 50 and 950 microseconds pulse width, readjust R20 on the record amplifier until ±2 microseconds is achieved for both the 50 and 950 microsecond pulse widths.

Step 26: Place the CP-100 in the STOP mode.

NOTE

Steps 27 through 29 should be performed only if the PDM record and reproduce modules are to accept or produce negative going pulses.

Step 27: Determine polarity conditions to be tested. See table 4-7 for jumper plug selections and figure 4-18 for jumper plug locations.

NOTE

Table 4-7, PDM Reproduce Jumper Plug Input-Output Configuration, has been combined with table 4-8, PDM Record Jumper Plug Input-Output Configuration, in a new table 4-7, PDM Module Jumper Plug Input-Output Configurations. This new table faces figure 4-18, PDM Jumper Plug Locations. Table 4-8 is deleted.

Step 28: Repeat steps 13 through 26 if the PDM Record jumper is changed to 180°.

NOTE

Observe oscilloscope preamplifier and triggering polarities, e.g., for a negative input pulse change "A" input polarity switch to negative.

Step 29: Repeat steps 1 through 12 if P1, P2, or P3 jumper plugs of the PDM Reproduce amplifier are changed.

NOTE

Observe oscilloscope preamplifier and triggering polarities.

Step 30: Change the "A" and "B" Time Base Triggering modes to (+) internal a.c. Change all jumper plugs on both modules to 0° position. Place the pulse generator polarity switch to positive.

NOTE

The pulse return period is adjustable in two ranges from 200 to 10,000 microseconds. The period is normally factory adjusted for 2,500 microseconds. Readjustment of this circuit is explained in steps 31 through 35.

Step 31: Place the PDM Reproduce Amplifier on the extension card. For a long time period the jumper plug P4 must be in the A-B position. Place the CP-100 in the Record mode.

Step 32: Adjust the pulse generator to the desired repetition rate.

Step 33: Set the generator pulse period long compared with the desired pulse return duration.

Step 34: Adjust R25 on the reproduce amplifier to the desired pulse return duration. The observed waveform should be similar to that in figure 4-23.

Step 35: Place the CP-100 in the STOP mode.

Step 36: For a short time period repeat step 30 with the following exception: the jumper plug P4 must be in the A-C position.

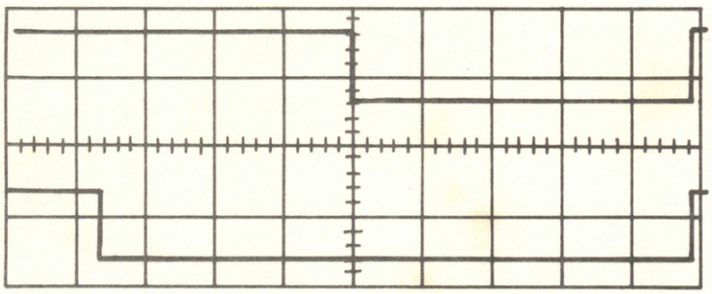


Figure 4-23. Pulse return waveform as set at the factory (2500 μsec)

4.45 MONITORING HEAD CURRENTS

4.46 DIRECT RECORD HEAD CURRENTS. The TEST/OPERATE switch is located in the recessed opening above the transport. When placed in the TEST position, it provides power to the record amplifiers so that the record head currents may be checked or adjusted without placing the transport in the RECORD mode.

4.47 Record head currents for a direct record amplifier can be measured at the jacks (on the front of the amplifier card) which parallel a ten-ohm resistor in the head return lead.

4.48 A-c meters or oscilloscopes, with a flat range of several hundred cycles per second up to better than 1.0 mc, are required to measure the currents.

4.49 As a guide to choosing suitable record head currents, it has been determined that using AMPEX 741 recording tape, 18 milliamperes (0.18 volt rms) of bias will provide frequency response within system specifications.

4.50 Signal record currents can be read at the same point by holding down the BIAS DISABLE switch, assuming a suitable signal is supplied to the record amplifier through the main signal input-output panel located at the left end or bottom of the recorder/reproducer. Using the same type of tape, it has been determined that 1.5 milliamperes (0.015 volt rms) at 500 cycles will result in recordings (at 30 ips) having a maximum of 1.4% third harmonic distortion.

4-51 The bias and record currents are chosen to give reasonable overall performance at all operating speeds. These currents can be changed for optimum signal-to-noise and minimum harmonic distortion at any ONE speed. Since minimum distortion and maximum S/N are conflicting end results of bias and signal currents, no ONE set of operating conditions will optimize all performance factors at all speeds.

4.52 The screwdriver-operated GAIN control on the front of the amplifier card can be adjusted to obtain the desired currents.

4.53 FM RECORD HEAD CURRENTS. The head current, at the jacks on the FM record amplifiers, can be monitored when the equipment is in the TEST or RECORD mode.

4.54 The current waveform should be nearly a square wave with a rise time of approximately 5 microseconds and peak-to-peak amplitude of approximately 0.5 volt. An Events Per Unit Time Meter or electronic counter can also be driven from the head current jacks.

4.55 The normal undeviated carrier frequency (in cycles per second this is equal to 1800 times the tape speed in ips) can be adjusted by the zero control (F_0) on the front of the amplifier. Maximum deviation of the carrier by the input signal should be plus or minus 40%, which is set by adjustment of the INPUT control.

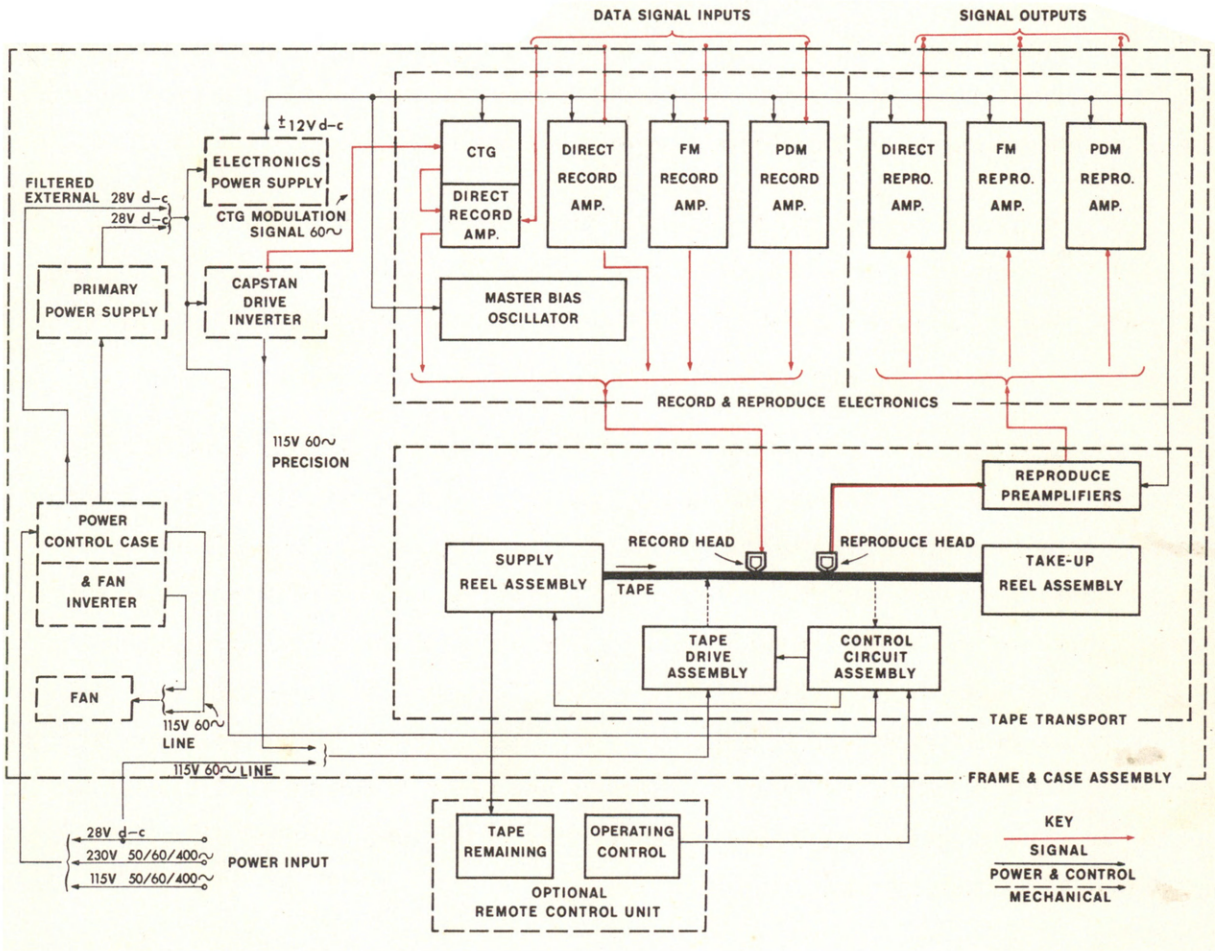
4.56 PDM RECORD HEAD CURRENTS. Head currents of the PDM record amplifier can be monitored at the jacks located on the front of the amplifier card when in the RECORD or TEST mode. The current should be a differentiated pulse of 0.35 volt peak-to-peak, ±10% and 10 μsec wide when measured at the 10% points. Head current is adjustable by means of variable resistor R37 on the PDM record amplifier.

CHAPTER 5

THEORY OF OPERATION

5.1 CP-100 RECORDER/REPRODUCER SYSTEM

5.2 The Block Diagram of the CP-100 System, Figure 5-1, shows the function of the entire system. The complete system consists of the Tape Transport and its associated control circuitry, one to fourteen Direct, FM or PDM Record Amplifiers, one to fourteen Direct, FM or PDM Reproduce Amplifiers, Master Bias Oscillator, three to fourteen Reproduce Preamplifiers, three separate Power Supply units, and a Power Control Case, and the Frame and Case Assembly. A combination Control Track Generator and Direct Record Amplifier unit is also available, as well as a remote control unit.



50970

Figure 5-1. Block Diagram, CP-100 Recorder/Reproducer

5.3 TAPE TRANSPORT

5.4 The Tape Transport provides facilities for transporting the magnetic recording tape past the Head Assemblies. The Tape Transport moves either 1/2-inch or 1-inch wide tape and reproduce heads at any of six tape speeds. The tape guiding elements and the head assemblies are referenced to a machined surface on the transport frame casting. The tape path is a single plane closed loop system. Throughout the Tape Transport, instrument-grade ball bearings are used to mount all rotating members.

5.5 The four assemblies comprising the Tape Transport and which are associated with the movement of the tape are as follows: the take-up reel assembly, the supply reel assembly, the tape drive assembly, and the control circuit assembly. Figures 8-1 and 8-2 are the Wiring Diagrams of the Recorder/Reproducer.

5.6 SUPPLY REEL ASSEMBLY. The supply reel assembly consists of a turntable assembly, a brake band assembly, and a tape tension arm assembly. The primary function of the supply reel assembly is to supply tape at constant tension. This ensures that a precise tension condition exists in the closed loop of the tape drive assembly.

5.7 The turntable assembly comprises a turntable brake drum assembly and a reel hold-down knob assembly. Three stainless steel dogs of the hold-down knob are cam-actuated by the hinged handle assembly, to lock into the grooves in the bore of the tape reel hub.

5.8 The brake band assembly consists of a brake band, a tension arm, a brake release solenoid, a double-leaf spring, and a tape guide. The tension arm, whose position is determined by tape tension, controls the action of the brake. In the REWIND or FAST FORWARD modes, the brake release solenoid (L1) is energized. The double-leaf spring is moved away from one end of the tension arm by the link pin of the solenoid engaging this spring. During the RECORD or REPRODUCE (DRIVE) mode, L1 is de-energized and the full force of the double-leaf spring is allowed to act against the tension arm. Any fluctuation in tape tension is applied to or released from the brake drum of the turntable assembly to compensate for any decrease or increase respectively in the tape tension. Rubber stops limit the travel of the tension arm.

5.9 The tape guide on the tension arm corrects any misalignment of the tape between the supply reel assembly and the supply guide of the tape drive assembly.

5.10 The tape follower arm assembly consists of the follower arm, a variable resistor (R3), and a spring-loaded catch. During loading of the supply reel, the catch holds the follower arm clear of the reel flanges. As tape is removed from the supply reel assembly, the follower arm follows the decreasing diameter of the tape pack. The follower arm is connected to the shaft of R3 which electrically forms one leg of a Wheatstone Bridge. As the arm moves, the resistance changes, and the TAPE REMAINING indicator (meter M1) on the Remote Control Unit (when part of the system) shows the fractional amount of tape remaining on the supply reel.

5.11 TAPE DRIVE ASSEMBLY. The magnetic recording tape is driven past the Head Assemblies by the action of the tape drive assembly. The drive assembly consists of a capstan assembly, two solenoid-operated pinch rollers, a turnaround idler, and entry and exit guides.

5.12 The capstan is driven at a constant rate by a two-speed hysteresis synchronous drive motor (B2) through a belt and pulley arrangement. Belt tension is controlled through a spring-loaded intermediate drive-ratio (cone) pulley. Electrical and mechanical factors in the supply of energy to any constant-rate drive system cause disturbances which in practice tend to cause oscillation within the system. These disturbances are minimized by the specially-designed spring-loaded drive motor pulley. The high inertia of the capstan prevents oscillatory disturbance to the capstan due to tape motion. The rate at which the capstan is driven is determined by the correct belt and pulley arrangement in conjunction with the position of the SPEED SELECTOR switch (S2).

5.13 Tape drive is achieved by the clamping action of the solenoid-operated pinch rollers onto the capstan, over which the tape passes, when the capstan solenoid (L2) is energized. As the turnaround idler reverses the direction of the tape in the closed loop, the photo-electric cell housed within the idler frame is subjected to pulses of light. The pulses are produced by the interruption of the light path between the light source and the light-sensitive crystal as the idler rotates. The pulses are a function of the tape speed and are used to operate the speed sensing circuit at 60, 30, and 15 ips speeds.

5.14 Since it is essential that the tape enter the closed loop of the drive system without misalignment, alignment is provided by the entry, center and exit tape guides. Tape alignment within the closed loop itself is maintained by the mutual parallelism of the capstan and the turnaround idler and their perpendicularity to the reference place established in the

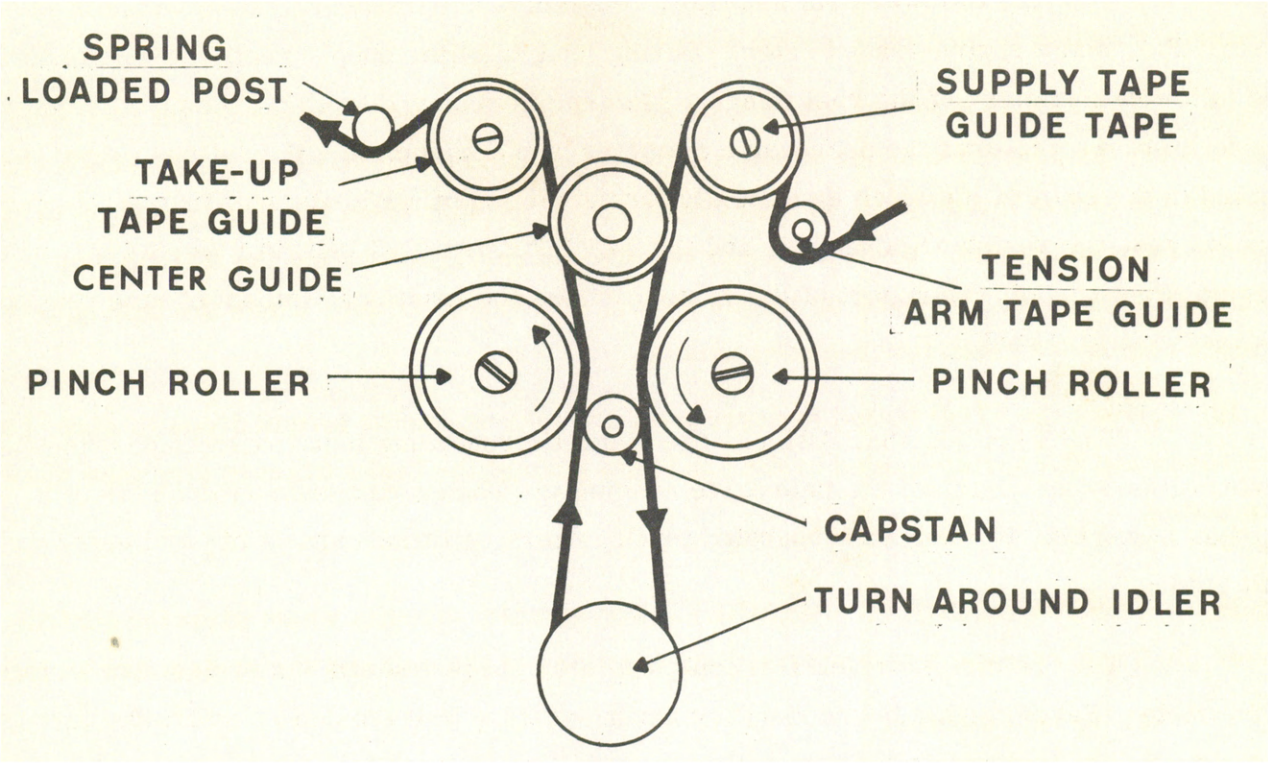


Figure 5-2 Closed Loop Tape Area

machining of the casting. Figure 5-2 shows the closed loop path formed by the tape.

5.15 As the tape passes through the tape drive assembly to the take-up reel assembly, it passes over the exit guide and a spring-loaded post attached to the guide. The guide maintains the centerline elevation of the tape to the take-up reel. The spring-loaded post is connected to the SAFETY switch (S1) which will be actuated by any interruption in tape tension, such as tape breakage, or end of tape, etc., in which case the Tape Transport will go into the STOP mode. If the system is being used with a Remote Control Unit, the FAULT indicator will light.

5.16 The Record/Reproduce Head Assemblies are isolated from each other by a mu-metal shield which forms a part of the turnaround idler frame. The mu-metal shield stops direct radiation between the head assemblies.

5.17 TAKE-UP REEL ASSEMBLY. As the tape leaves the tape drive assembly it is wound onto an empty reel mounted on the take-up reel assembly. This assembly consists of a turntable-brake drum assembly, a reel hold-down knob assembly, a torque motor, a spring-loaded brake band and a brake release solenoid (L3). L3 is energized, releasing the brake, during all operative modes. In the STOP mode L3 is de-energized allowing the

brake to function to stop tape motion smoothly.

5.18 The reel is mounted onto the turntable and is clamped in place by the reel hold-down knob (as described under supply reel assembly). In the DRIVE or FAST FORWARD modes the torque motor (B1), at high torque, pulls the tape from the supply reel up to speed under reduced tension. When the pinch rollers are energized during the RECORD or REPRODUCE mode, the take-up torque motor, at reduced torque, winds the tape onto the empty reel under relatively constant tension.

5.19 When the STOP button is depressed, the take-up motor torque drops to zero, L3 releases and the spring-loaded brake band acts against the brake drum to stop tape motion smoothly.

5.20 CONTROL CIRCUIT ASSEMBLY. The specific circuits which exercise control over the Tape Transport and intermediate functions of the unit and the system are as follows:

a) Speed Selection
b) Local and Remote Operating Control
c) Speed Sensing

5.21 Figure 8-3 is the schematic diagram of the Tape Transport Control Circuits. When system set-up is complete, power may be applied to POWER INPUT receptacle connector J17. A principal ground return loop for all control relays is made through the Remote Control Unit. When the Remote Control Unit is not used, the dummy plug connector P15 must be inserted into the receptacle connector J15 to establish ground continuity for the control circuitry.

5.22 The SAFETY switch S1 also forms part of this ground return and is held closed by proper tensioning of the tape. Any loss of tape tension actuates the SAFETY switch through the spring-loaded post on the take-up guide.

5.23 SPEED SELECTION. The selection of any of the six tape speeds 60, 30, 15, 7-1/2 3-3/4, and 1-7/8 inches per second (ips) is controlled by the SPEED SELECTOR switch S2 and the appropriate belt and pulley arrangement.

5.24 The ratios of the speeds are 1:2:4:8:16:32. Belt and pulley arrangements group the tape speeds into three ranges: 60 and 30, 15 and 7-1/2, 3-3/4 and 1-7/8 ips. Switch S2 is a screwdriver adjustment accessible through a hole in the motor cover on the top of

the transport. Adjacent to the SPEED SELECTOR switch is a colorwheel indicator hole whose color code must agree with that shown through the color code indicator holes on the various amplifiers for the particular speed chosen. Assuming correct belt and pulley arrangement, matching colors will assure that tape speed and frequency sensitive plug-in elements coincide.

5.25 Switch S2 is a six-pole, six position rotary switch. Two poles, S2A and S2C, determine the winding arrangement of the capacitor-run two-speed hysteresis synchronous drive motor B2. As shown on the schematic diagram, one set of windings is used for tape speeds of 60, 15 and 3-3/4 ips and another set of windings is used for tape speeds of 30, 7-1/2 and 1-7/8 ips. Pole S2E is used in determining the specific torque needed to wind the tape onto the take-up reel assembly at a particular tape speed. The remaining poles are used in conjunction with the speed sensing circuitry.

5.26 LOCAL AND REMOTE OPERATING CONTROLS

5.27 Direct operation of the system is controlled by the switches mounted on the Tape Transport. The same control can be exercised at any distance up to one hundred feet when a Remote Control Unit is used. (If a distance of greater than 25 feet is desired consult AMPEX Service Engineering Dept. for wire size). Both types of controls are equipped with backlighted switches which show the operational mode of the system at any time. Local operating controls are shown on schematic diagram, Figure 8-2. Figure 8-4 is the schematic diagram of the remote control unit. The operating controls and functions are shown in Table 5-1.

5.28 POWER SWITCH S11. When switch S11 is pressed, power is supplied to the entire system and power indicator lamps DS 11 and DS 16 light. When the switch is pressed a second time, power is removed from the entire system and the power indicator lamp is no longer illuminated.

5.29 DRIVE SWITCH S12. The momentary closing of the DRIVE switch completes the ground return of relay K2 through the normally-closed contacts of the STOP switch, and the DRIVE indicator lamp DS12 will light. The ground return for relay K2 supplied by the DRIVE switch is now replaced by the closing of latching contacts. Series resistors R1 and R7 are shunted out of take-up torque motor (B1) circuit by contacts of K4 to provide maximum

Table 5-1. CP-100 Operating Controls

CONTROL	TYPE	GENERAL FUNCTION
POWER switch S11 *(S21)	locking pushbutton	applies and removes input power
DRIVE switch S12 *(S22)	momentary pushbutton	starts tape motion by applying power to take-up motor
FAST FORWARD switch S13 *(S23)	momentary pushbutton	starts tape motion in forward direction at a fast rate
REWIND switch S14 *(S24)	momentary pushbutton	causes tape to rewind on to the supply reel at a fast rate
RECORD switch S15 *(S25)	momentary pushbutton	starts recording operation
STOP switch S16 *(S26)	momentary pushbutton	stops tape motion in any mode

*( ) Switch located on remote control unit.

torque for pulling the tape up to speed; the BRAKE RELEASE solenoid L3 is actuated also, to provide reduced tension in the tape by removing the brakes from the take-up turntable. Contacts of the drive relay K2 activate the speed sensing circuit.

5.30 Once the Speed Sensing Circuit determines the correct speed of the tape for 15, 30 or 60 ips operation, relay K5 is energized. One set of its contacts completes the ground return for CORRECT SPEED relay K4. Latching contacts keep relay K4 energized. The BRAKE RELEASE solenoid is energized and the CAPSTAN solenoid L2 is actuated and clamps the pinch roller against the capstan to drive the tape. The shunting effect across resistor R1 only, in the torque motor circuit, is removed and motor B1 runs at reduced torque to wind the tape onto the take-up reel assembly. Tape tensioning is accomplished by the mechanical brake servo of the supply turntable assembly.

5.31 At the three lower speeds, the release of L1 and the clamping action of the pinch rollers occur, almost at the same time tape motion commences. The time lag in the speed sensing circuit is sufficient for the tape to start motion before the pinch rollers actually clamp the tape against the capstan. The shunting effect is removed from both R1 and R7 at tape speeds of 7-1/2, 3-3/4 and 1-7/8 ips.

5.32 FAST FORWARD AND REWIND SWITCHES. During the FAST FORWARD and REWIND modes, the selected switch on the control cluster is backlighted and the brakes are released on both supply and take-up turntables by solenoids L1 and L3 respectively. Dynamic tape tension is accomplished by exciting the field of the trailing d-c torque motor through a resistor R8, and loading the armature winding with a loading resistor R9. The leading d-c torque motor's field and armature windings are connected in series and energized to provide take-up torque. The DRIVE function is locked out through the contacts of K9 and K10 delay relays which also cause an approximate 2-second stopping time between REWIND and FAST FORWARD modes.

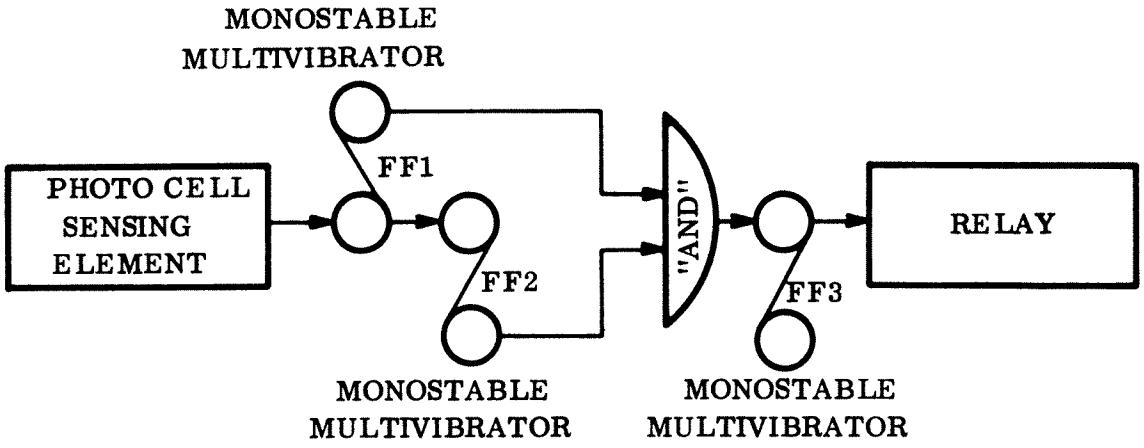
5.33 In addition to the above operating controls, the Remote Control Unit contains a TAPE remaining meter and FAULT indicator.

5.34 The TAPE REMAINING meter is connected across a bridge formed by four resistors, two of which are potentiometers. One of the potentiometers is connected to the tape follower arm of the supply reel, and the other three resistors are mounted on the same etched circuit card as the speed sensing circuit. The other three resistors, R17, R19 and R20, complete the bridge. The potentiometer attached to the follower arm and potentiometer R20 can be adjusted to calibrate the "full" or "empty" readings on the meter.

5.35 The FAULT indicator lamp lights when a fault is detected in the operation of the system, such as broken tape or the end of tape, or when the tape is not at the proper tension to allow proper operation of the transport.

5.36 THREE-SPEED SENSING CIRCUIT. Systems having a Tape Transport Serial Number of 189 for the -6 version (235 for -5 version) or above, use speed sensing on the 60, 30, and 15 ips speeds. As shown in the Block Diagram (Figure 5-3) and schematic (Figure 8-5), transistors Q1 and Q2, Q3 and Q4, Q5 and Q6 form three monostable multivibrators, FF1, FF2, and FF3, each with its associated circuitry. Resistor R11, diodes CR4, CR5 and CR6 form an "AND" gate. All three monostable multivibrators are in use when switch section S2D is in the 60, 30, or 15 ips position.

5.37 The voltage change across R1 at the input of Q1 is produced by the change in resistance of the photo-sensitive crystal, as the crystal is subjected to the light pulses. The light path between the lamps and the photo-sensitive crystal is complete any time that one of the eight narrow slots, machined 45° apart on the idler, is in line with the small



50972

Figure 5-3 Block Diagram Three-Speed Sensing Circuit

opening which exposes the light-sensitive crystal. The light pulses are formed by the interruption of the light path. The rate at which the pulses are formed is a function of the tape speed.

5.38 C6 and R8 form a time constant of approximately 3 milliseconds for FF2 at a tape speed of 60 ips. Switch S2B places C4 in parallel with C6, at a tape speed of 30 ips, to increase the time constant to approximately ten milliseconds. Switch S2F places C11 in parallel with C6 and C4, at a tape speed of 15 ips, to increase the time constant to approximately twenty-eight milliseconds.

5.39 As the tape motion increases for 60 ips operation, the voltage change across series resistor R1 causes FF1 to produce a train of four-millisecond pulses, one for each pulse of light striking the photo-sensitive crystal. The timing of the pulse trains produced by the multivibrators, when the tape speed is either below or in the desired speed, is illustrated in Figure 5-4. The pulse from FF1 is fed to CR4, one half of the "AND" gate. At this point, there is no output from FF2, so that the "AND" gate is closed. When FF1 resets, it triggers FF2 to produce a three-millisecond pulse. The "AND" gate remains closed since there is no pulse from FF1.

5.40 When the tape has reached the proper speed, FF1 produces a pulse before FF2 has reset. As this occurs, the "AND" gate opens for the duration of the overlap pulse between the trailing edge of FF2 and the rising edge of the FF1 pulse. This action produces

another pulse which triggers FF3. Transistor Q5 is conducting during the charging time of capacitor C7, approximately 100 milliseconds. This places one side of relay K5 to ground and the relay is now energized. At the same time relay K4 is energized to operate the capstan solenoid L2. Both relays K4 and K5 remain energized through their respective latching contacts.

5.41 For a tape speed of 30 ips, the sequence of events is identical with the foregoing, except that the pulse duration of the FF1 pulses is changed from three to ten milliseconds, and at 15 ips, the pulse duration is changed to approximately twenty-eight milliseconds.

5.42 At the tape speed of 7-1/2 ips FF2 is not used, due to diode CR5 being disconnected from the "AND" gate. FF1 is triggered by a voltage change and applied at the input, (generated by light pulses from the photo-sensitive crystal). FF3 is triggered directly by FF1 and functions as described above. The speed sense circuitry is bypassed at 3-3/4 ips and 1-7/8 ips, with the pinch roller action commanded by the DRIVE button.

5.43 RECORD/REPRODUCE ELECTRONICS

5.44 All components of the Record/Reproduce Amplifiers are mounted on printed circuit cards which plug into card racks on the front of the frame, next to the Tape Transport. Each card has a molded combination handle and front panel which contains all test adjustment points. Input, output, and power connections are made through a connector at the rear edge of the card which mates with a connector in the rear of the card racks. As many as fourteen cards can be accommodated in each of the two card racks. Each amplifier card will fit into any slot in its own card rack, but is keyed so that record and reproduce cards cannot be interchanged. Dummy amplifier cards can be inserted in unused rack slots.

5.45 One record amplifier card is required to record each track of data on the tape. Reproduction of each track requires a reproduce amplifier. The reproduce preamplifiers are mounted in a shielded card rack directly behind the heads at the rear of the Tape Transport. The Master Bias Oscillator provides bias signal for all direct record amplifiers through the rear connector of the record amplifier card rack.

5.46 Special combination Direct Record Amplifier and Control Track Generator Cards are available to record servo tape speed control information. Only one such combination card is required per system.

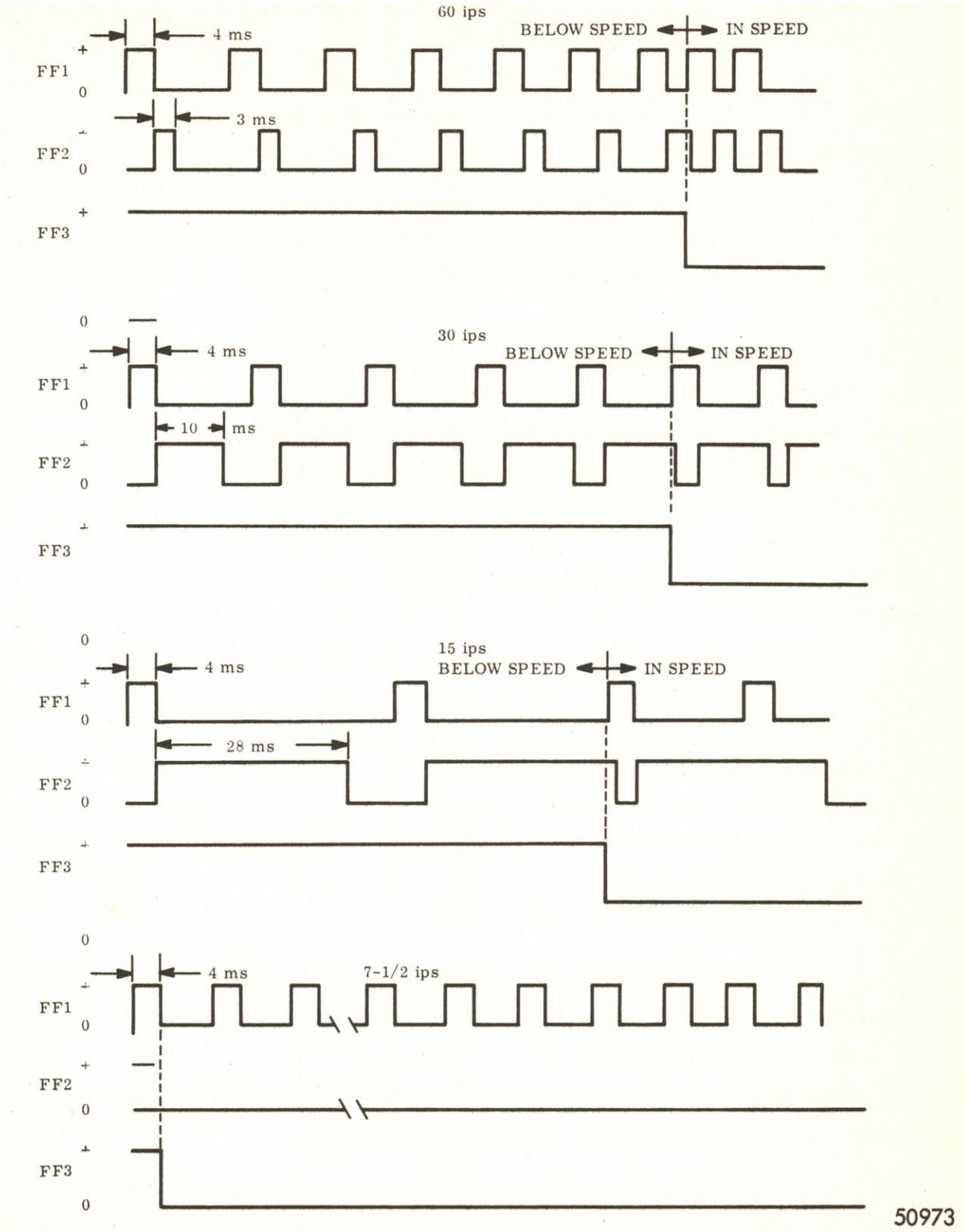
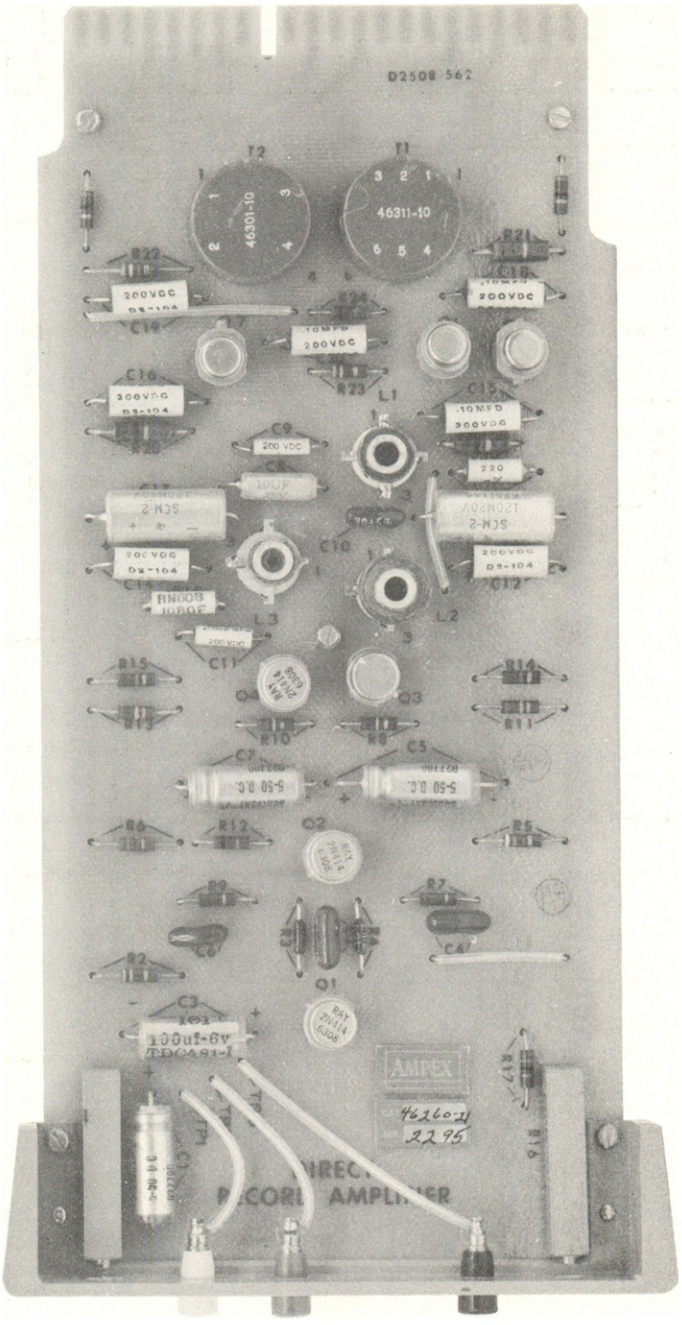


Figure 5-4 Three-Speed Sensing Pulse Train Timing



8437-0

Figure 5-5 Typical Direct Record Amplifier

5.47 DIRECT SYSTEM

5.48 DIRECT RECORD AMPLIFIER

5.49 The Direct Record Amplifier (see Figure 5-5) accepts wideband data signals which are mixed with the 1.0 mc bias signal from the master bias oscillator in order to drive the record heads.

5.50 Block Diagram, Figure 5-6 (and schematic, Figure 8-6) shows that the direct record amplifier consists of two amplifying sections: a data signal amplifier to drive the record head, and a bias amplifier. The direct record amplifier is used to drive wideband heads, and requires a bias signal, supplied through the record rack connector from the master bias oscillator.

5.51 Signal and bias levels can be measured at the HEAD MONITOR test jack on the record amplifier card front panel. Input connections are made through the input/output connector panel. Output is connected to the record heads through the internal wiring harness. Input signal level and bias level may be adjusted on the record amplifier card front panel.

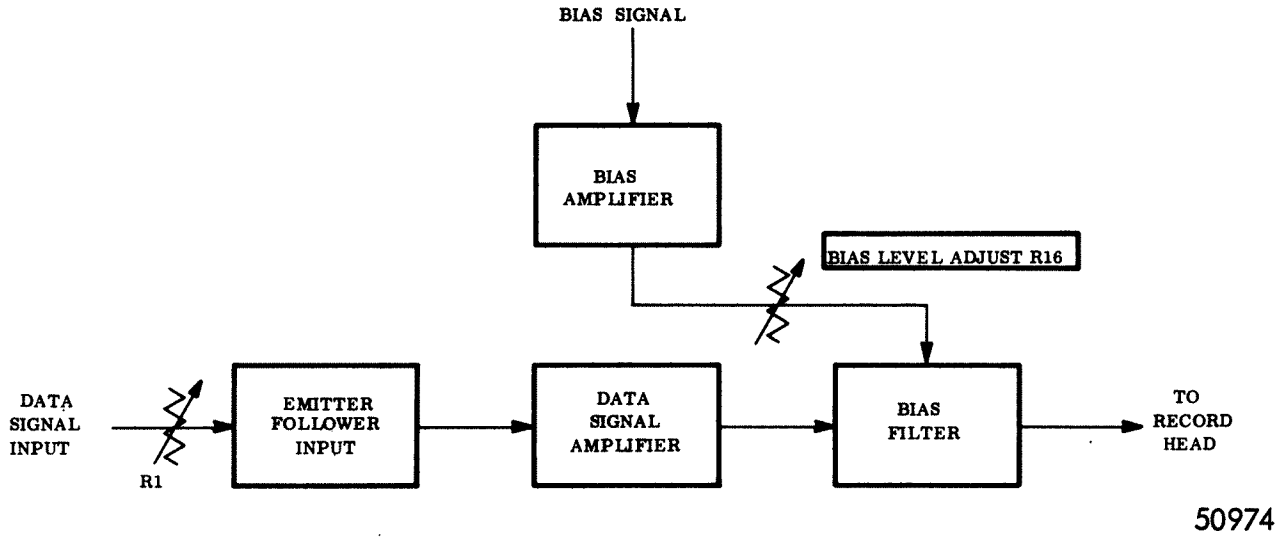
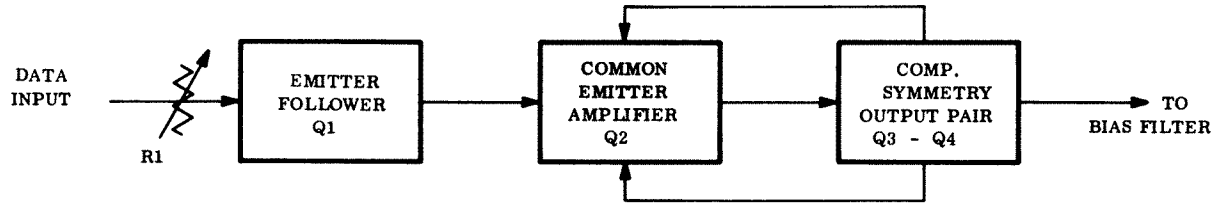


Figure 5-6 Block Diagram, Direct Record Amplifier

5.52 DATA SIGNAL AMPLIFIER. The data signal amplifier (see Figure 5-7) is essentially a constant-current device; it is intended to produce an output current proportional to input voltage regardless of any variable impedance presented by the record head. This constant current characteristic is obtained by using a large amount of negative current feedback. Eddy losses, leakage, etc., inherent in the record head, result in a loss of approximately 3 db at 250 kc. To provide constant flux recording, compensation is provided for these head losses.



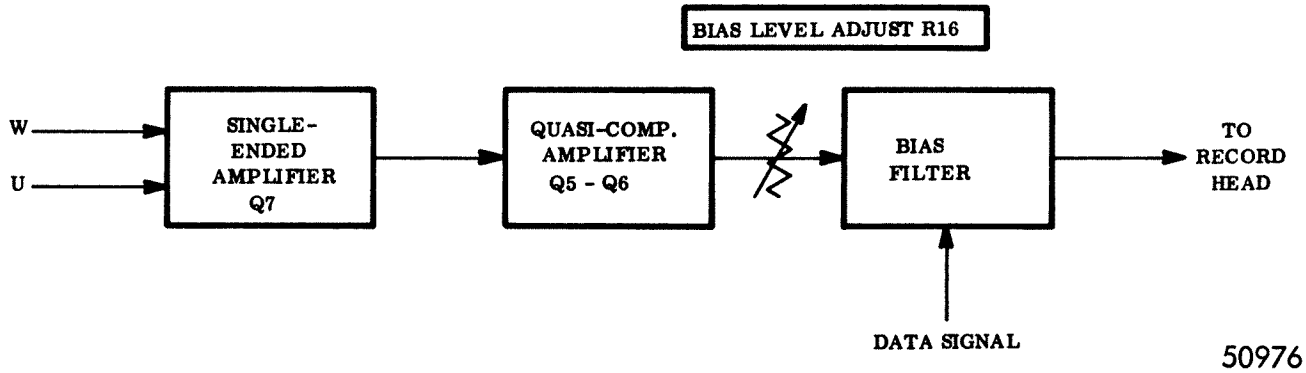
50975

Figure 5-7 Block Diagram, Data Signal Amplifier Circuit

5.53 The data signal input is connected through the module connector in the record rack. Included in the input circuit is an uncompensated voltage divider attenuator, adjustable through the front of the record amplifier panel, by means of which incoming signals may be attenuated to any desired level. The input impedance of the direct record amplifier consists of the parallel resistance of the variable attenuator R1 and the base of the emitter follower stage Q1. A series coupling capacitor C1 is placed in the input circuit to block any d-c components present in the data. The output of the emitter follower stage Q1, is applied to the data signal amplifier through a network composed of R3, R4 and C2. The 3 db, 250 kc compensation is added to the data signal through C2 and R4.

5.54 The head driver portion of the data signal amplifier is composed of Q2, Q3 and Q4. Transistor Q2 functions as a common emitter amplifier to drive complementary pair Q3 and Q4, an inherently stable d-c amplifier. The output of the complementary symmetry pair is coupled to the record head through a 1.0 mc parallel-resonant circuit, L1 and C9, which blocks the bias frequency from entering the data signal amplifier.

5.55 BIAS AMPLIFIER. The bias amplifier accepts the bias signal generated by the Master Bias Oscillator and amplifies it prior to mixing with the data signal. (See Figure 5-8.)



50976

Figure 5-8 Block Diagram, Bias Amplifier Circuit

5.56 The input to the bias amplifier is a standard class A transformer-coupled circuit. A small amount of negative feedback is provided through R23 and R24. Loading effects on the Master Bias Oscillator are minimized through the use of a step-down transformer. Capacitor C18 is used to provide a low impedance path for the bias signal across R21. Transformer T1, wound with a bifilar secondary, is used to provide a symmetrical coupling of the square wave collector current between the collector of Q7 and the bases of Q5 and Q6. The quiescent collector voltage of Q7 is approximately centered (0 volt d-c) with a zero bias input. The collector voltage at this point, with normal bias signal, is dependent on the base-to-emitter characteristics of Q5 and Q6.

5.57 Because of the phasing effect of the bifilar secondary of T1, the quasi-complementary stage Q5 and Q6 may be considered a paired switch. The action of Q5 and Q6 provides 1.0 mc signals with square wave characteristics. The amplitude of the bias signal output is controlled directly by a +12 volts d-c and -12 volts d-c bus, and is held constant despite any variations in bias signal input level or transistor parameter.

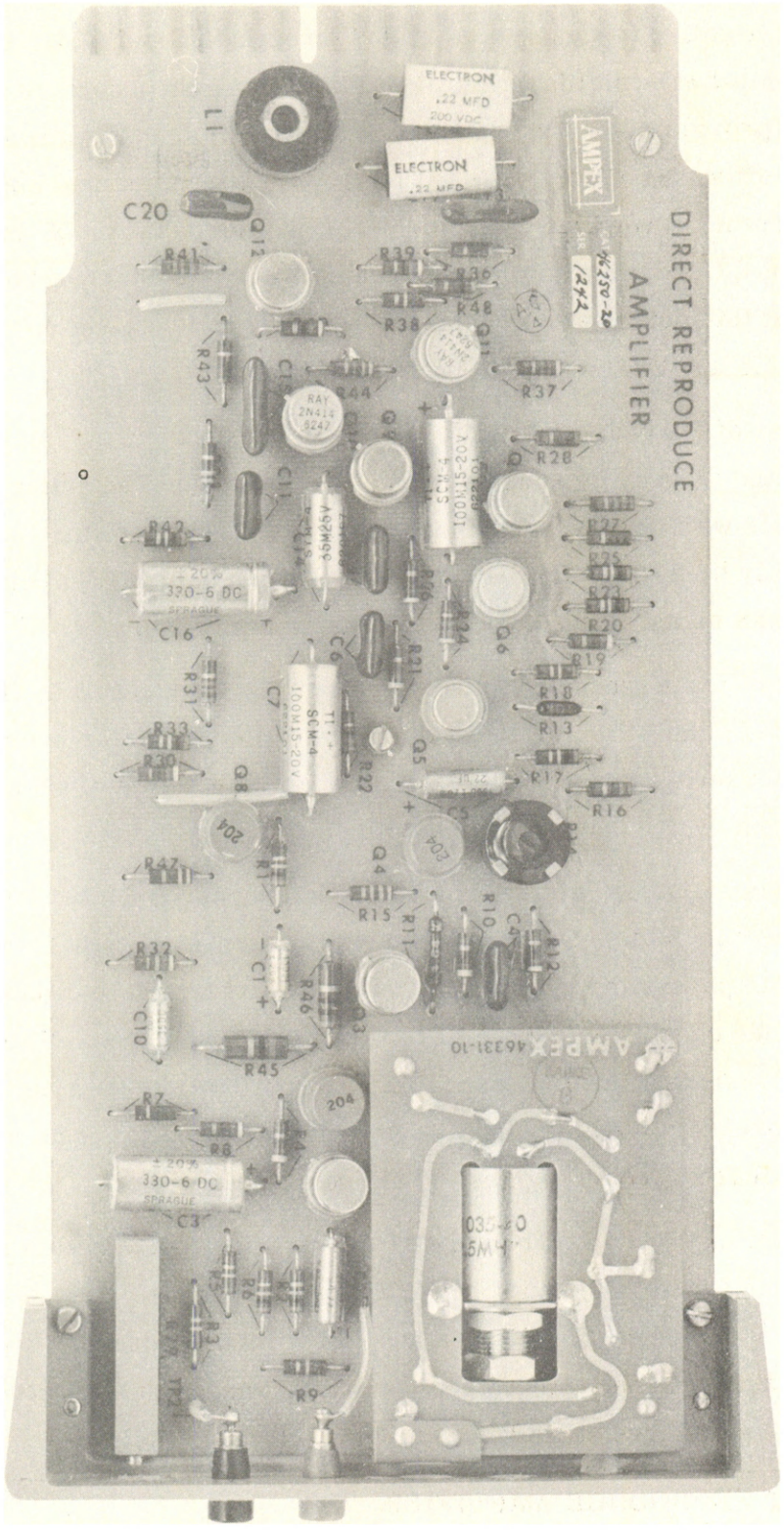
5.58 Any significant second harmonic bias current may result in distortion or increased noise in the recorded data. The low d-c resistance of L4 forces the average voltage at the collector of Q6 to be zero. In conjunction with the limiting action of Q5 and Q6, this forces a symmetrical output, which appears at the collector of Q6.

5.59 This bias signal is filtered by a network composed of R16, R17 and L4, the parallel resonant circuit L3 and C11, and the series resonant circuit L2 and C10. The filter circuit of L2 and C10 passes the bias current but presents a high impedance load to the data signal amplifier, thus causing data current to flow through the head. The parallel resonant circuit L1 and C9 presents a low impedance to the record head with a high impedance to the bias signal. This prevents the bias signal from entering the data signal amplifier section, while allowing signal frequencies to pass to the record head.

5.60 Capacitors C12, C13, C14 and C17 prevent the bias currents in the quasi-complementary stage Q5 and Q6 from feeding back into the single-ended stage Q7, or into the data signal amplifier by way of the +12 volts d-c and -12 volts d-c busses. Voltage transients, which could induce head magnetization when the power is applied, are decoupled by capacitors C12 and C14 in series with resistors R25 and R26.

5.61 DIRECT REPRODUCE AMPLIFIER

5.62 The Direct Reproduce Amplifier (see Figure 5-9) accepts signal data from a reproduce preamplifier, amplifies the signal, and provides frequency equalization and phase correction.



8437-2

Figure 5-9 Typical Direct Reproduce Amplifier

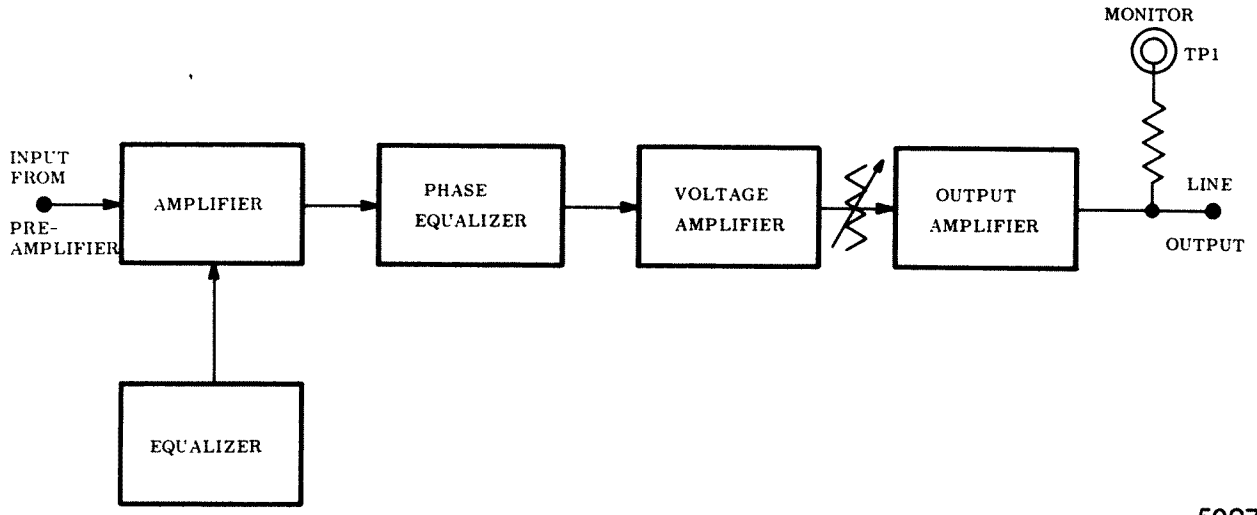


Figure 5-10 Block Diagram, Direct Reproduce Amplifier

5.63 As shown in block diagram, Figure 5-10 and schematic diagram (Figure 8-7). the amplifier consists of the following stages: an amplifier, amplitude equalizer, phase equalizer, voltage amplifier, and an output amplifier. Two different types of plug-in equalizer assemblies are available for each tape speed. One type provides equalization for a standard head (with response up to 100 kc) and the other for a wideband head (with response up to 250 kc).

5.64 The wideband equalizer assemblies, used in conjunction with the CP-100 wideband reproduce heads, will provide amplitude equalization for data recorded on CP-100 or FR-600 recorders. The standard band equalizer assemblies, used in conjunction with CP-100 standard band reproduce heads, will provide amplitude equalization for data recorded on an FR-100 recorder.

5.65 Input to the reproduce amplifier is through the internal wiring harness. Output is available at the connector panel. Output level and equalizer adjustments are made at the reproduce card front panel. L1 and C20 reject 1.0 mc bias signals at the input of the reproduce amplifier.

5.66 AMPLITUDE EQUALIZER. The signal output of the pre-amplifier to the direct reproduce card is made through the printed circuit connector. The input stage consists of transistors Q2 and Q3 in a common emitter-collector configuration. Transistor Q1 constitutes the collector load of Q2, providing a desirable low d-c resistance in combination with a high a-c impedance. A feedback loop consisting of resistors R4 and R8 provides d-c stabilization. The signal is filtered from this loop by capacitor C3.

5.67 Figure 5-11 shows a typical equalizer curve (the shape of the curve is the same for all equalizer assemblies). The response is adjustable only in two areas, but the relationship of the other components is considered as a matter of interest:

1) Area A is controlled by the value of R2. A reduction in the magnitude of this resistance will decrease the height of this area.
2) Area B, the depth of mid-band attenuation, is controlled by the value of R1; the degree of attenuation increases as resistance decreases.
3) The shape of the curve in Area C is controlled by the ratio of R1 to R4 (R4 being variable). Within Area C, a decrease in the resistance of R4 will result in increased amplitude.
4) Point D peaking frequency is determined by the values of C1 and L1. An in crease in the value of either C1 or L1 will lower the peaking frequency.
5) Area E, the elevation of Point D, is controlled by the value of the variable damping resistor R3. An increase in the value of this resistor will increase the elevation of the peak.

5.68 PHASE EQUALIZATION. Phase equalization or phase correction is achieved by differentiating a portion of the amplitude equalizer output, rotating the phase 180° through Q4, and re-combining this signal with the equalizer output as applied to the following stage. No net frequency discrimination is produced by the selective phase shift. The phase linearity thus achieved permits transmission of square waves within a minimum overshoot and without significant degradation of amplitude response over the specified bandwidth.

5.69 VOLTAGE AMPLIFIER. The voltage amplifier raises the level of the output from the phase equalizer sufficiently to drive the output amplifier. The voltage amplifier consists of three directly coupled stages, transistors Q5, Q6 and Q7. All stages are operated in the common-emitter mode. The input to the voltage amplifier is directly coupled from the output of the phase equalizer. A compensated feedback loop, consisting of resistors R21, R22 and R26 and capacitors C6, C7 and C8 provides both signal and d-c feedback around the voltage amplifier.

5.70 OUTPUT AMPLIFIER. The output amplifier is designed to provide power to drive long, low-impedance lines. Input to the section is through common-emitter stage Q8, which drives complementary symmetry pair Q9 and Q10 and which, in turn, drives a second complementary symmetry pair Q11 and Q12. Sufficient resistance is introduced into the collector circuit of the final complementary symmetry pair to prevent excessive current flow in case

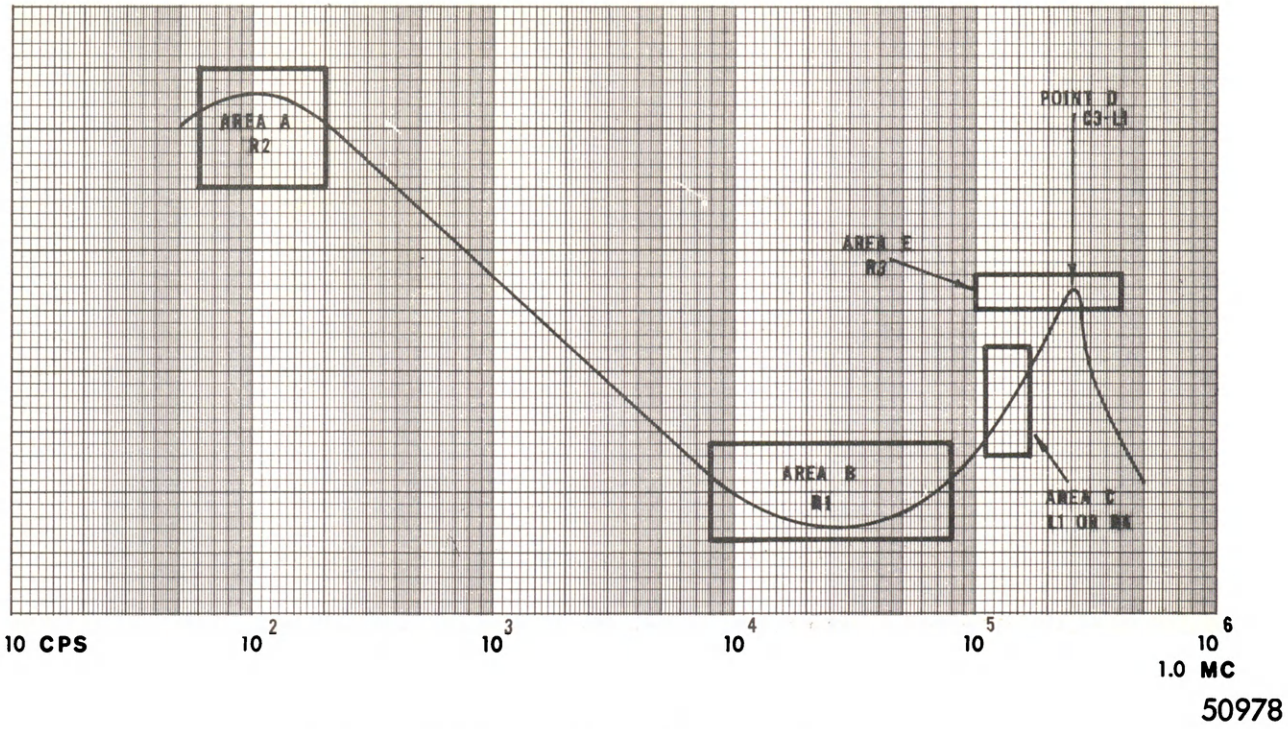


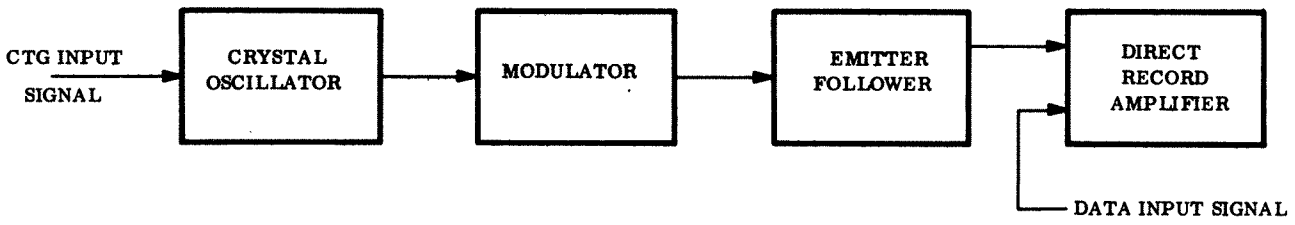
Figure 5-11 Equalizer Response Curve

of a shorted output. A single compensated feedback loop, consisting of resistor R34 and capacitor C11, provides both signal and d-c feedback.

5.71 CONTROL TRACK GENERATOR

5.72 The Control Track Generator (CTG) provides a composite output signal, consisting of an amplitude-modulated carrier frequency mixed with amplified data and bias signals. This output signal, provides a servo tape speed control, when recorded on tape. The unit can be operated at a carrier frequency of either 17.0 kc or 18.24 kc, by installing an accessory crystal for the desired frequency. The CTG plugs into any slot on the record amplifier card rack located on the CP-100 frame assembly. It receives bias signal drive from the Master Bias Oscillator, and power from the regulated ±12 volts d-c electronics power supply. Modulation voltage is obtained from the capstan drive inverter.

5.73 The unit consists of a crystal controlled oscillator, a modulator, an emitter follower stage and a direct record amplifier. The circuits of the CTG, with the exception of the record amplifier, will be discussed in subsequent paragraphs. The theory of operation for the Direct Record Amplifier is identical to that discussed in paragraphs 5.48 through 5.61 of this chapter. Figures 5-12 and 8-8 provide a block diagram and schematic reference respectively for the circuitry of the CTG.



50979

Figure 5-12 Block Diagram, Control Track Generator

5.74 CTG CRYSTAL-CONTROLLED OSCILLATOR. The oscillator is formed by crystal Y1 which is in the feedback loop of Q8 and Q9, a two-stage crystal oscillator. Feedback resistor R30 provides temperature stabilization for the unit. The output voltage of the oscillator appears at the collector of Q9 and is fed back to Q8 through the network composed of Y1, R32, C24, CR1 and CR2. The output of the oscillator is coupled to the modulator through transformer T3A; the primary of this transformer, in conjunction with C22, provides a tuned load for the collector of Q9.

5.75 CTG MODULATOR. The modulator is formed by Q10 and Q11 and low pass filter (T3B and T3C). A 60 cps modulating frequency is provided by a transformer on the output of the Capstan Drive Inverter. This frequency is applied to the base of Q10, swinging the collector supply of Q11 sinusoidally. The carrier frequency is fed through the secondary of T3A to the base of Q11, a single-ended, Class B amplifier. The primary of T4, in conjunction with C26, forms a broadly tuned load for the collector of Q11. C27 provides a by-pass for the carrier signal. The input from the Capstan Drive Inverter is normally adjusted with MOD control R26 to produce 50 percent modulation of the carrier.

5.76 The secondary of transformer T4 feeds a low pass filter section, composed of T3B, T3C, C28, C29 and C30, which removes unwanted frequencies. The OUTPUT potentiometer R36 controls the output level of the Control Track Generator. The emitter follower stage (transistor Q12) couples the unit to the input of the direct record amplifier section.

5.77 The mixing circuit combines the amplitude-modulated carrier frequency with data signals. The direct record amplifier portion of the module accepts wide band signals which are mixed with an amplified bias signal for driving the record head.

5.78 The Extractor handle of the Control Track Generator Cards contains four adjustment points and six test points. The adjustment points are as follows:

a) BIAS CURRENT, this adjustment provides a means by which the bias current may be adjusted from 15 to 28 ma.

b) CONTROL TRACK INPUT (modulation), this adjustment is normally set to give 50% modulation.

c) CONTROL TRACK OUTPUT, which allows the output level to be adjusted from 0 to 20 volts peak-to-peak and which is normally set for 5 volts peak-to-peak.

d) SIGNAL INPUT, which allows adjustment of the input data signal from 0.7 to 10 volts (rms).

5.79 The TEST POINTS are:

Ground - black
Head Monitor - red
Data Signal Input - white
Control Track Input - blue
Control Track Output - green
Control Track Oscillator - white

5.80 MASTER BIAS OSCILLATOR

5.81 The Master Bias Oscillator is used to supply a 1.0 mc bias signal in all systems using direct record amplifiers. This bias signal is subsequently amplified in each of the individual direct record amplifiers before being mixed with the data signal and presented to the record head. Resistor R200, on the record card rack, is used to provide proper cable termination for the bias circuit regardless of the number of direct record amplifiers employed.

5.82 The basic frequency generating portion of the Master Bias Oscillator is a Butler oscillator circuit, consisting of grounded base amplifier Q1, emitter followers Q2 and Q3, and a crystal in the positive feedback loop. The voltage gain of the grounded base amplifier

and the current gain of the two emitter follower stages provide the loop gain required for oscillation. At the same time they minimize degeneration resulting from collector-to-base capacitance.

5.83 Q1 is a conventional grounded base amplifier stage (see schematic, Figure 8-9). Inductor L1 provides the voltage appearing at the collector of Q1. The amplitude of this voltage is limited by the negative supply voltage and the small d-c voltage present at the base of Q1. Because of the large amplitude of the square wave at the collector of Q1, the emitter follower stages Q2 and Q3 are essentially 1.0 mc switches. With the crystal removed from the circuit, the quiescent emitter voltage of Q2 and Q3 is approximately centered.

5.84 The output of Q2 and Q3 is fed to transformer T1 and the quasi-complementary amplifiers Q4 and Q5, which form the bias drive stage. These two transistors function as a paired switch.

5.85 Voltage divider circuit R12 and R13, shunted by C6 and C7, provides a d-c voltage centered between ground and the negative side of the supply. This d-c voltage is coupled directly through the transformer primary to both quasi-complementary amplifiers for symmetrical operation. The output of the quasi-complementary stage is coupled through transformer T2, which is wound with a bifilar secondary. This double winding minimizes a symmetry in capacitance between the cable shield and the two conductors.

5.86 FM SYSTEM

5.87 FM RECORD AMPLIFIER

5.88 The Frequency Modulation (FM) Record Amplifier (Figure 5-13) provides a frequency-modulated signal output to drive the record head. The modulation of the FM carrier corresponds to the data signal introduced at the input. Input connections are made at the input/output connector panel. The FM output is connected to the record head through the internal wiring harness. Signal current levels may be measured at the HEAD MON. test jack on the record amplifier control panel. Input level may be adjusted at the FINE and COARSE DEVIATION ADJ. potentiometers on the record amplifier panel.

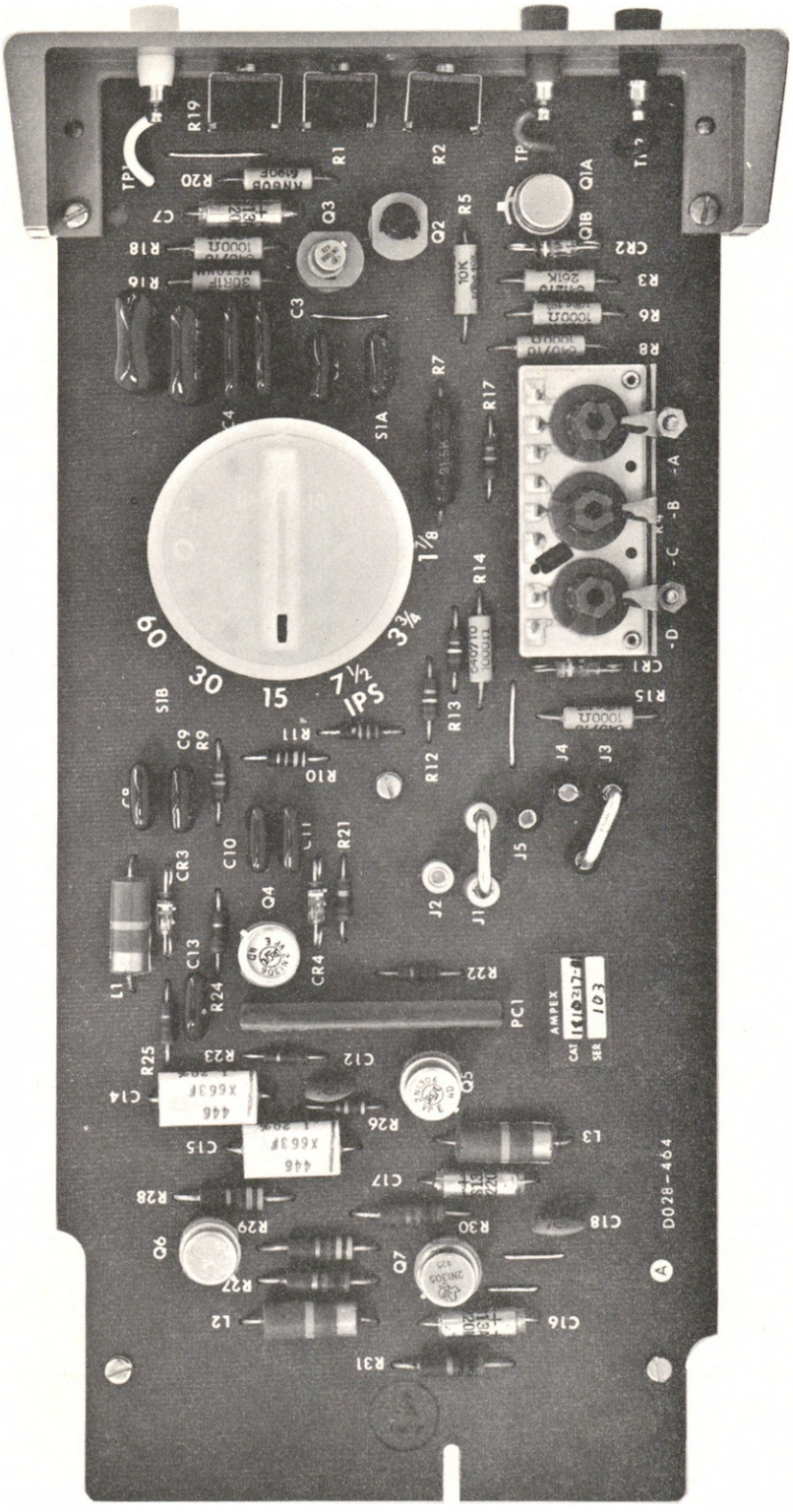


Figure 5-13. Typical FM Record Amplifier 8971-4

5.89 With the COARSE DEVIATION ADJ. potentiometer set for maximum deviation, allowing the input signal voltage to be applied directly across the input, the amplifier will produce a peak frequency deviation of ±40% for a 500-millivolt rms input signal. A positive voltage produces an increase in frequency from the center carrier frequency, and a negative voltage produces a decrease in frequency. Table 5-2 lists the relationship between the center carrier, peak frequency deviations, and the data bandwidth for each tape speed.

Table 5-2 Frequency Vs. Tape Speed

TAPE SPEED (IPS)	CENTER CARRIER FREQUENCY (KC)	±40% DEVIATION (KC)	NOMINAL DATA BANDWIDTH
60	108	±43.2	DC to 20 KC
30	54	±21.6	DC to 10 KC
15	27	±10.8	DC to 5 KC
7-1/2	13.5	± 5.4	DC to 2.5 KC
3-3/4	6.75	± 2.7	DC to .25 KC
1-7/8	3.375	± 1.35	DC to .625 KC

5.90 Frequency selection is accomplished by S1, a six-position rotary switch on the record amplifier board. The record amplifier must be realigned if the frequency selection is changed.

5.91 The following circuit description divides the FM record amplifier circuitry into three major sections: the voltage-to-frequency converter, the bistable multivibrator, and the output driver. See the block diagram, Figure 5-14, and the schematic, Figure 8-10.

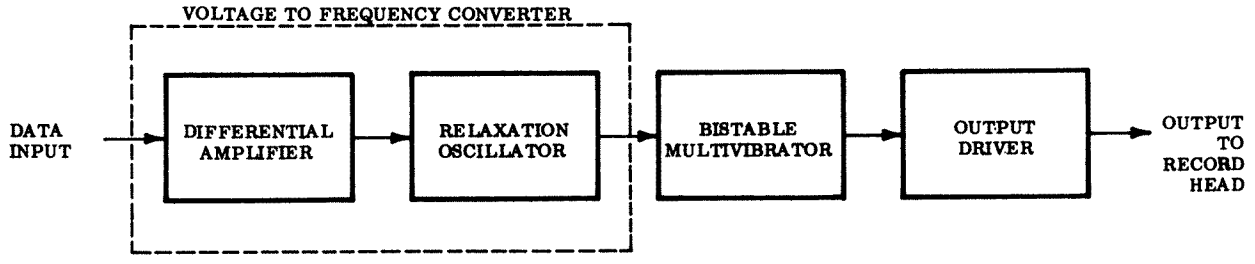


Figure 5-14. Block Diagram, FM Record Amplifier

5.92 VOLTAGE TO FREQUENCY CONVERTER. The voltage-to-frequency converter consists of two stages: a differential amplifier and a relaxation oscillator. The function of the converter is to provide an output signal whose frequency varies in direct proportion to the data input signal.

5.93 The input signal is impressed across DEVIATION ADJ resistors R1 and R2 and applied to the base of transistor Q1A. The signal is then coupled through resistors R6 and R8 from the emitter of Q1A to the emitter of Q1B. Diode CR1 and its associated resistors shunt R6 and R8 for positive input signals, causing the gain of transistors Q1A and Q1B to increase. This increase effectively compensates for any non-linearity that may occur in the switching action of the relaxation oscillator. Transistors Q1A and Q1B constitute a differential amplifier whose collector currents change in response to the input data signal. Zero bias for the base of Q1A is established by potentiometer R4A and resistor R3 to prevent the flow of direct current through the DEVIATION ADJ resistors, R1 and R2. Coupling and current limiting for the emitters of Q1A and Q1B are provided through R7, which connects to the positive d-c supply. Temperature stabilization is accomplished by resistors R4B, R4C, and diode CR2. Resistors R14 and R15 afford a means of varying current through Q1A and Q1B, to compensate for differences in component values. Either or both of these resistors may be jumper-bypassed or left unbypassed to achieve the required compensation.

5.94 The current from the collector of Q1B is applied to a timing capacitor, causing it to charge linearly in a positive direction. Any one of six timing capacitors (C1 thru C6) can be selected by means of the carrier frequency selector switch, S1. The sawtooth signal developed across the selected capacitor is coupled to the emitter of Q2.

5.95 Transistors Q2 and Q3 constitute a relaxation oscillator which functions as a voltage-triggered switch to discharge the timing capacitor instantly. The frequency of the switching action is changed by varying the capacitor charging current and by selecting a different capacitor. The characteristics of the switch are such that, as long as voltage across the timing capacitor is less than a reference voltage at the base of Q2, the switch is open. The reference voltage for the oscillator is established by resistors R18, R19, and R20. When the voltage across the capacitor becomes greater than the reference voltage, the emitter-base junction of Q2 is forward biased and collector current flows. The collector current of Q2 is coupled to the base of Q3, turning it on.

5.96 When Q3 turns on, the reference voltage decreases and Q2 conducts heavily. The turn-on action is therefore regenerative, switching Q2 and Q3 into a state of heavy conduction. This helps the timing capacitor to discharge rapidly.

5.97 When the voltage across the timing capacitor is low enough that the emitter-base junction of Q2 is no longer heavily forward-biased, the base current of Q3 is reduced. Reducing the base current of Q3 decreases its collector current, allowing the reference voltage and the base voltage of Q2 to return to normal. This effectively stops conduction of transistors Q2 and Q3 and the capacitor again will start charging and will continue to charge until the voltage across it is greater than the reference voltage. The output of the switch is a negative pulse which is generated each time the switch turns on. This pulse is then coupled through capacitors C8 and C9 to two steering diodes used to trigger a bistable multivibrator.

5.98 BISTABLE MULTIVIBRATOR (FLIP-FLOP). The function of the multivibrator is to accept short negative-going pulses from the output of the relaxation oscillator and to convert these pulses into rectangular waveforms.

5.99 The oscillator is intentionally designed to run at double the desired output frequency so that pulses from it may be used to drive the flip-flop to its alternate states at the desired frequency. The negative-going pulses from the relaxation oscillator are coupled through capacitors C8 and C9. The flip-flop is triggered through diode CR3 or CR4, depending upon which transistor is conducting. If transistor Q4 is off, its collector will be at a high potential, reverse-biasing diode CR3 through resistor R21. No pulse will be applied to the base of Q4. Transistor Q5 will be on and its collector will be close to ground potential. Diode CR4 will be slightly forward-biased and will pass the negative pulse to the base of Q5, cutting it off. The cutting off of Q5 applies a positive pulse to the base of Q4, turning it on, completing the reversal of the flip-flop states for one input trigger. The next trigger will pass CR3, which will cut off Q4, returning the flip-flop to its original assumed states. In this way, the flip-flop completes one cycle for each pair of trigger pulses from the oscillator. Capacitor C13 and resistor R24 couple the flip-flop output to the output driver.

5.100 OUTPUT DRIVER. The function of the output driver is to provide a modulated driving current for the recording head.

5.101 The output of the multivibrator is coupled to the bases of complementary transis-

tors Q6 and Q7 through a "speed-up" circuit consisting of capacitors C14, and C15 and resistor R26. Transistors Q6 and Q7 act as a complementary electronic switch, alternately driven to saturation or cut-off. Current limiting and inter-coupling for the emitter and collector circuits of Q6 and Q7 is provided by resistors R27 through R30.

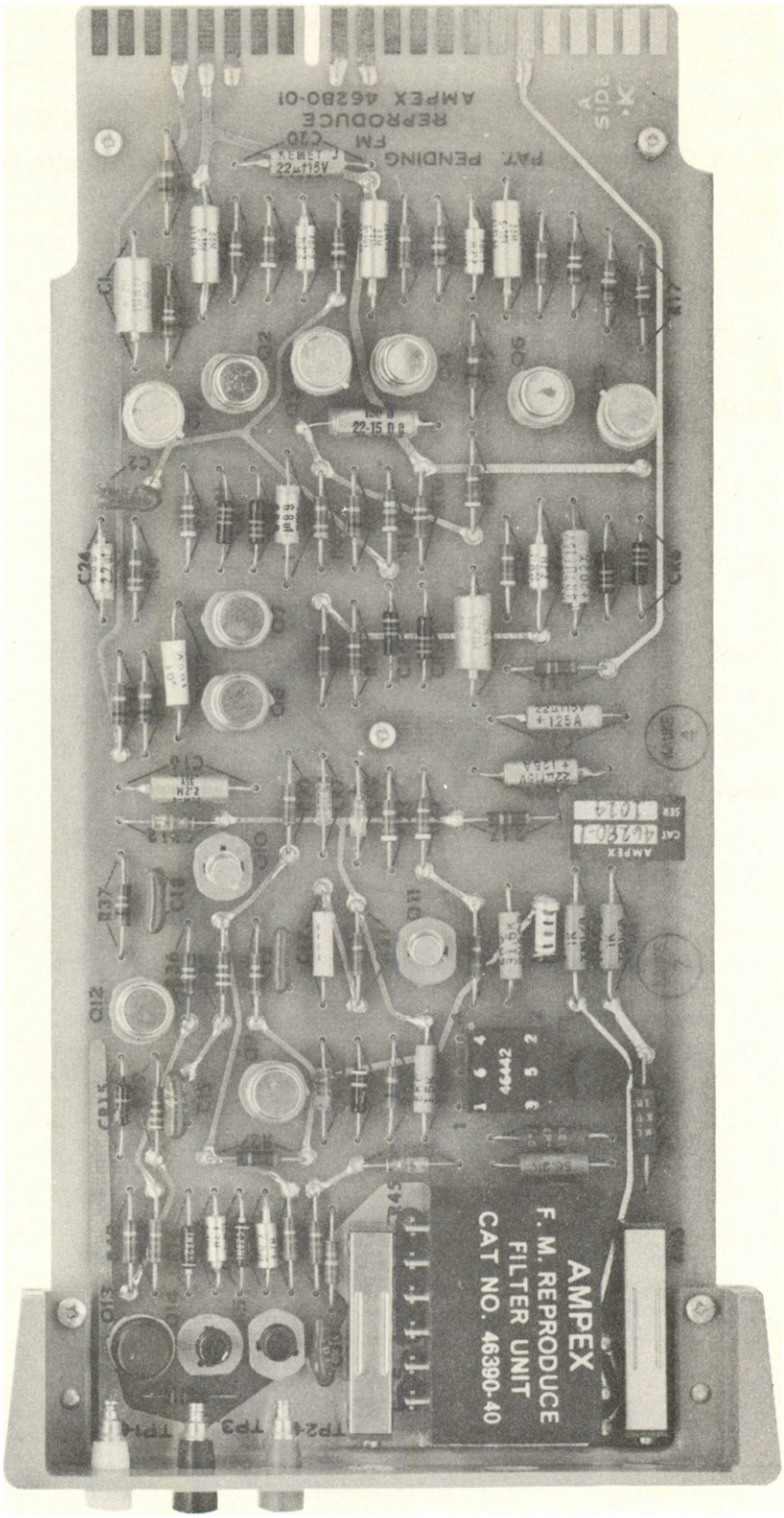
5.102 Decoupling networks are provided to confine the signal currents within specified circuits. The components that make up the decoupling networks are C7, C12, C16, C17, C18, and L1, L2, and L3.

5.103 DELETED

5.104 DELETED

5.105 FM REPRODUCE AMPLIFIER

5.106 The Frequency Modulation (FM) Reproduce Amplifier (see Figure 5-15) demodulates the FM input signal from the reproduce preamplifier and provides an analog output. The input signal from the preamplifier is connected to the reproduce amplifier card through the internal wiring harness.



8437-6

Figure 5-15 Typical FM Reproduce Amplifier

5.107 The reproduce amplifier produces a 1.0 volt rms output into a 10,000 ohm load, fed from an output impedance of 1000 ohms. The frequency of the output extends from d-c to a cutoff frequency determined by the tape speed and output data filter. Separate filters are available for each tape speed. Table 5-3 shows the relationship between the center carrier frequency and the filter cutoff frequencies for each tape speed.

Table 5-3 Frequency vs. Tape Speed

TAPE SPEED (ips)	CENTER CARRIER FREQUENCY (KC)	±40% DEVIATION (KC)	NOMINAL DATA BANDWIDTH
60	108	±43.2	DC to 20 KC
30	54	±21.6	DC to 10 KC
15	27	±10.8	DC to 5 KC
7-1/2	13.5	± 5.4	DC to 2.5 KC
3-3/4	6.75	± 2.7	DC to 1.25 KC
1-7/8	3.375	± 1.35	DC to .625 KC

5.108 The output signal may be monitored at the OUTPUT test jack on the front of the amplifier card. Two potentiometer adjustments are provided. The ZERO control adjusts the output for 0 volt d-c with a center carrier frequency input. The GAIN control adjusts the output, (nominally 1.0 volt rms) with a fully deviated (±40%) input.

5.109 The circuit of the FM reproduce amplifier consists of six sections: limiter, frequency doubler, multivibrator, ramp generator, blocking oscillator, and output driver. See block diagram, Figure 5-16 and schematic, Figure 8-11.

5.110 LIMITER. The limiter amplifies and reshapes the output signal from the pre-amplifier into a usable form. There are three stages. Each stage is a standard limiter circuit, providing an output signal 180° out of phase with the input signal.

5.111 Input resistor R1 prevents overloading and C1 provides d-c isolation from the preamplifier to the base of Q1. The first amplifier, Q1, is an emitter follower amplifier which drives Q2, a direct-coupled phase inverter-amplifier. Non-linear feedback is accomplished by the feedback network composed of CR1, CR2, C3 and R2. The output voltage at the collector of Q2 is fed back to the base of Q1. Negative feedback is employed and as a result an increase in the output voltage increases the conduction through the diodes,

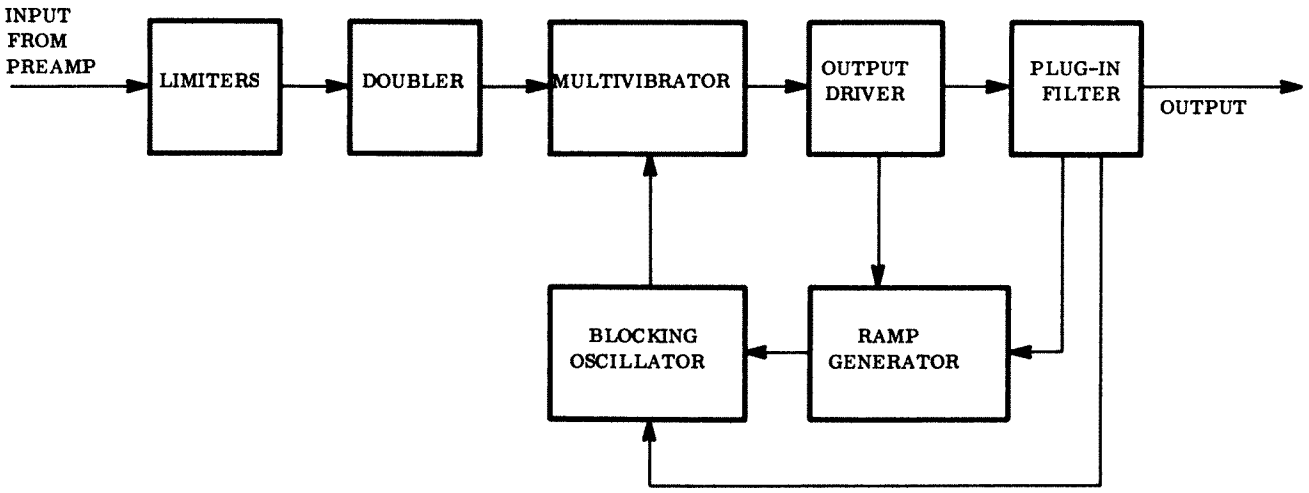


Figure 5-16 Block Diagram, FM Reproduce Amplifier

resulting in symmetrical limiting. R2 provides d-c stabilization for transistor leakage current changes. R6 and R7, of the amplifier stage, limit collector current and determine the operating point of Q2. C4 is a bypass capacitor which eliminates transient voltages, on the emitter of Q2. The function performed by the components in the second and third limiter stages are the same as for the first limiter.

5.112 An input network (TEST INPUT jack) at the base of Q3 permits the use of an external signal source to test the FM reproduce amplifier while it is operating in the reproduce card rack.

5.113 DOUBLER. The doubler circuit provides a negative trigger pulse to the multivibrator at every crossover point of transient time of the input signal.

5.114 The output of the limiter stage is capacitively coupled to the base of Q7. The value of the capacitor is large enough to pass the lowest expected frequency of the signal. The negative-going pulse turns Q7 on, which drives its emitter more negative. The emitters of Q7 and Q8 are capacitively coupled by C12. Therefore the negative-going potential of Q7 is differentiated by this capacitor and a negative voltage spike is imposed on the emitter of Q8. The negative spike turns Q8 off completely for the duration of the spike. This causes the collector of Q8 to go negative, resulting in a negative pulse which forward-biases diode CR7. The diode conducts, setting the multivibrator. At the same time the collector of Q7 goes more positive due to the turning on of this transistor. The positive potential, however, is blocked by CR8, and the off-transistor will not reset the

multivibrator. The positive-going output of the limiter stage turns off transistor Q7, causing its collector to go more negative. This results in diode CR8 conducting to set the multivibrator. When Q7 is turned off its emitter goes positive. The positive voltage is differentiated by C12 imposing a positive spike on the emitter of Q8, turning this transistor on. The collector of Q8 then goes more positive although the more positive potential will not reset the multivibrator due to the blocking action of CR7. The result of this process is a negative pulse being imposed on the base of transistor Q10 during each transient time of the limiter stage. In the interval between the two negative pulses, the multivibrator is reset by the blocking oscillator. The final result is the doubling of the frequency out of the limiter stage.

5.115. MULTIVIBRATOR. The multivibrator re-establishes the d-c levels for the trigger pulses out of the doubler and the blocking oscillator.

5.116. Negative pulses from the output of the doubler cause CR7 and CR8 to conduct and impose a negative voltage to the base of Q10. This turns the transistor off and the emitter voltage goes negative. Since the emitter is coupled through C16, in series with parallel resistor-capacitor network R37 and C18 to the base of Q12, this negative voltage turns Q12 on. When Q12 turns on, its collector voltage becomes positive. The positive voltage is coupled by R40 to the collector of Q10, which then goes positive. This positive voltage is coupled to the base of Q9 through the parallel RC network composed of C15 and R29, turning Q9 off.

5.117. When Q9 turns off, its collector goes negative. The negative voltage is coupled to the base of Q10 through the parallel RC network of R28 and C13, keeping Q10 off until a negative pulse from the blocking oscillator resets the multivibrator at the base of Q9. Therefore, the multivibrator is a bistable circuit set by a negative pulse from the doubler and reset by a negative pulse from the blocking oscillator. R27 is a current-limiting resistor for Q9, and supplies off-bias to Q10. CR10 is a protective device to prevent the base-to-emitter voltage of Q9 from being exceeded. CR12 is a clamping diode which prevents the input to Q12 base from being greater than +12 volts. CR15 provides off-bias voltage to transistor Q12. The diode is actually a stabistor chosen for its dynamic forward impedance. Resistor R36 performs the function of providing off-bias for transistor Q12. C13, C15 and C18 provide overdrive to their respective transistor bases to speed up the transient times at these transistor outputs. The assymmetry of the output of the blocking oscillator to reset the multivibrator has a fixed delay time determined by the value of C28 in the plug-in filter unit. R33 ensures that Q9 will turn on when the power supplies are initially turned on.

5.118 RAMP GENERATOR. The output of the output driver is coupled to the ramp generator circuit. The ramp generator provides drive to the blocking oscillator at a fixed

delay time. This time is determined by the value of resistors R44, R45 and R52 and the value of capacitor C28 in the plug-in filter.

5.119 The output of the driver stage is coupled to the base of the ramp generator transistor Q15 through a differentiating network composed of C27, R35 and CR19. C27 has a different value for each speed and is included in the plug-in filter unit. The value is selected to pass the lowest carrier frequency expected at each speed. Therefore, C27 provides d-c isolation from the output of the driver stage. Q15 is normally held on by the bias voltage provided by R38, connected to the -12 volt d-c supply. Voltage at the base of the transistor is determined by divider network composed of R38, R39, CR19 and R35. A positive portion of the square wave of the output driver stage is imposed on the base of Q15 through C27, C30, CR19 and R39 turning the transistor off. Q15 is held off by a network composed of R35, CR19, R39 and CR18. With Q15 off the same positive voltage discharges C28 at a rate determined by the time constant of this capacitor and resistors R44, R45 and R52. Since C28 is initially charged to approximately -6 volts, the positive voltage tends to charge the capacitor in the opposite polarity. But since the trigger to the blocking oscillator is referenced to ground potential, the output voltage of the ramp generator does not get much more positive than ground, because the triggered blocking oscillator changes the state of the multivibrator, which in turn changes the polarity of the output of the driver stage.

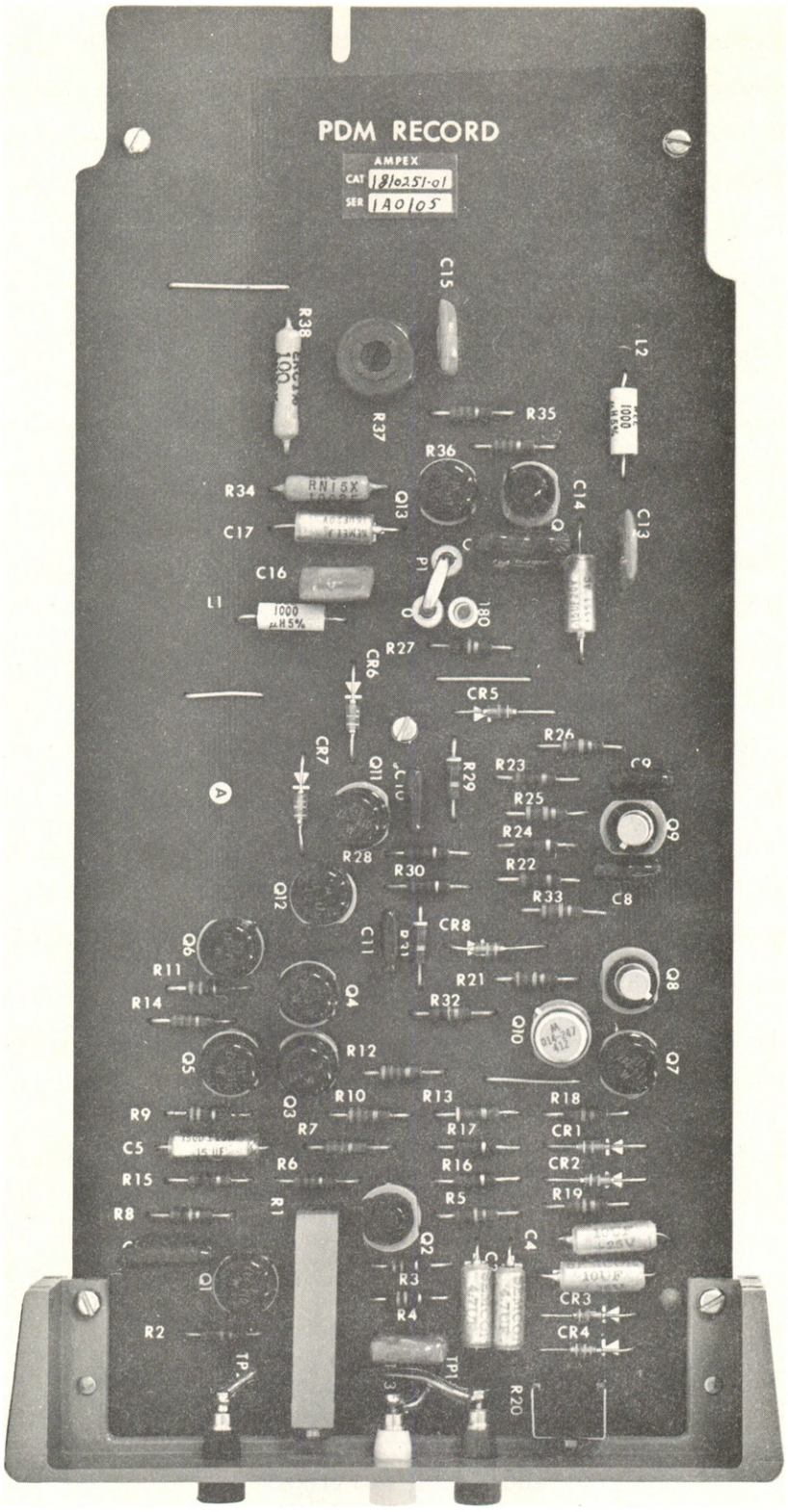
5.120 The change in the output stage polarity results in Q15 turning on. This is accomplished in the following manner: The negative voltage makes the junction of R35, C27 and CR19 temporarily negative. This reverse-biases CR19 and the base of Q15 is brought up to a negative potential through R38, turning Q15 on. With Q15 on, there is a low impedance charging path to charge C28 to -6 volts. Since the collector of Q15 is connected to the zener reference voltage of CR17, the capacitor is charged to a relatively stable source. Also, an added charging path is provided from the output of the driver stage by a resistive network composed of R45, R44 and R52, the value of each (R44 and R52) being selected for optimum temperature compensation. Q15 remains on until the multivibrator is set by the negative pulse out of the doubler stage. The cycle is then repeated.

5.121 BLOCKING OSCILLATOR. The Blocking Oscillator provides the negative reset pulse for the multivibrator. The circuit provides a fast rise time pulse with a fixed pulse width.

5.122 The output from the ramp generator is coupled to the primary winding of the pulse transformer through CR13. This diode normally has reverse bias and therefore will not conduct until the ramp generator output approaches ground potential. CR14 provides the ground reference level for triggering the blocking oscillator. Since the triggering point of the blocking oscillator depends on the equality of the forward characteristics of these two diodes, the diodes are a matched pair (and are encapsulated). As the ramp generator approaches ground potential, CR13 conducts, which drives the base of transistor Q11 more positive. This turns Q11 on and causes current to conduct through the secondary winding of the pulse transformer. The collector of Q11 then goes more negative. The current in the secondary winding is fed back positively to the base of the transistor. This regenerative action drives the base more positive, turning the transistor on harder. It is through this regenerative action that a fast rise time is obtained in the output. The duration of the pulse is determined by the inductance of the pulse transformer. R32 and R34 provide the bias voltage to keep transistor Q11 in its normally off condition. C14 stabilizes the emitter of Q11. R31 is a damping resistor. The negative-going pulse is coupled through C17, causing CR9 to conduct. This diode is attached to the base of Q9, and the negative pulse causes Q9 to turn on, which resets the multivibrator.

5.123 OUTPUT DRIVER. The output of the multivibrator is directly coupled to the output driver stage. This stage performs the function of current amplification and voltage amplitude limiting of the output voltage to the filter.

5.124 Q13 and Q14 are a complementary pair of transistors which provide a positive and negative level output voltage. This level change is required to provide a positive and negative d-c voltage output from the filter. The bases of the two transistors are common. A positive voltage at its base will cause Q13 to conduct, bringing the output voltage to a positive level of +6 volts as determined by the zener reference diode, CR16. A negative voltage imposed on its base will cause Q14 to conduct and transistor Q13 to cut off, bringing the output to a negative level of -6 volts as determined by the zener reference diode CR17. R41 provides the current required by the zener diode CR17 and also limits the collector current through Q14. R42 performs the same function for the complementary transistor, Q13. The output is fed into an integrating filter with a d-c output that is a function of the amplitude and assymmetry of the output driver voltage. R46 is a variable potentiometer which adjusts the d-c output voltage level. The sensistors R50 and R51 are used for temperature compensation. The temperature coefficient of the sensistor is such



8971-2

Figure 5-17 Typical PDM Record Amplifier

that higher temperatures result in an increase in resistance value, thus compensating for the change of the resistance value of the inductors in the filter. This tends to stabilize the gain out of the reproduce amplifier with respect to temperature. C25 and C26 bypass large transient voltages across the zener reference diodes, thereby stabilizing the reference voltage.

5.125 The power supply to the limiter stages is de-coupled from other sections of the FM Reproduce Amplifier by a network composed of R47, R48, C19, C21, C20 and C22.

5.126 The plug-in filter unit contains capacitor C14, C27, C28 and a three stage integrating filter composed of inductors and capacitors. C28 is selected for close tolerances because of its function as a timing capacitor in the ramp generator. A printed circuit ground shield is provided on the amplifier to prevent interaction between the module and the printed circuit.

5.127 PDM SYSTEM

5.128 PDM RECORD AMPLIFIER

5.129 Duration-modulated pulses are recorded by the PDM record amplifier (see Figure 5-17). The unit first differentiates a rectangular input waveform and then drives the record head with the resulting positive and trailing negative spikes. These positive- and negative-going spikes correspond in time to the leading and trailing edges of the input pulse. The tape is now magnetically marked with pulses that may be used to trigger pulse-reconstruction circuitry during the reproduce process.

5.130 The circuitry of the PDM Record Amplifier consists of a current amplifier, phase splitter, full-wave rectifier, pulse shaper and control stage, bistable multivibrator, and driver. Figures 5-18 and 8-12 respectively show the block diagram and schematic of the PDM Record Amplifier. The operation of each circuit is discussed individually in subsequent paragraphs.

5.131 CURRENT AMPLIFIER. The input signal is coupled through resistor R1 and capacitor C1 to the bases of transistors Q1 and Q2, a complementary-symmetry push-pull current amplifier. The output of this amplifier is coupled directly to the base of transistor Q3, one-half of the phase splitter circuit. Capacitor C2 adds about 1 microsecond to the

input pulse rise and decay times. This permits control of pulse duration for input pulses with very fast rise and decay times.

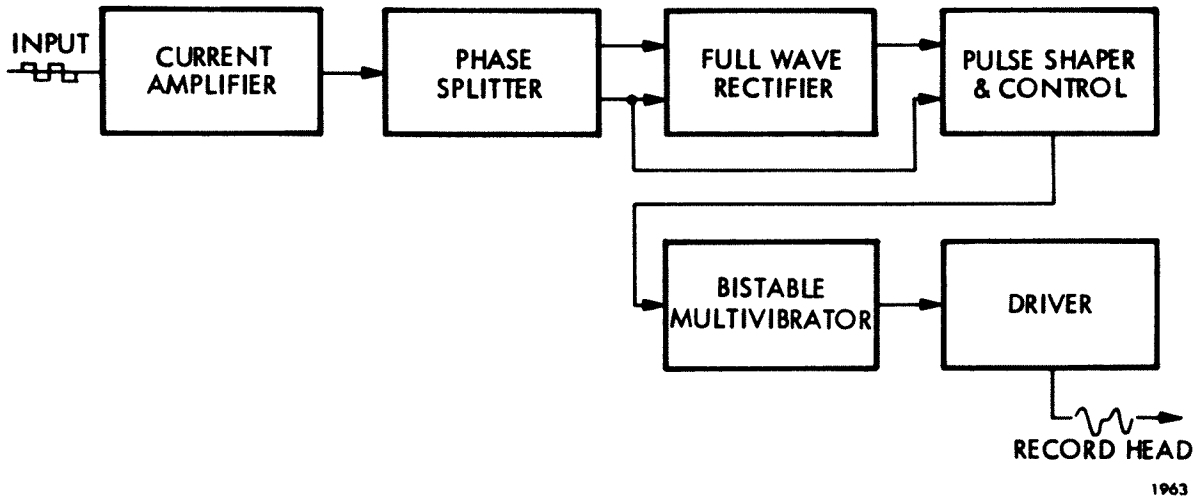


Figure 5-18 Block Diagram, PDM Record Amplifier

5.132 PHASE SPLITTER. The output of current amplifier Q1, Q2 is fed to the base of transistor Q3. This signal is inverted by Q3, but is also coupled without inversion from the Q3 emitter, through resistors R10 and R12 to the Q4 emitter. The output signal produced from the Q4 collector in response to the emitter input is not inverted. The outputs from the collectors of Q3 and Q4 are coupled directly to the bases of emitter followers Q5 and Q6. The Q6 output is coupled to the pulse shaper and control stage and the full-wave rectifier through capacitor C4. The Q5 output is coupled to the full-wave rectifier through capacitor C3.

5.133 FULL-WAVE RECTIFIER. The full-wave rectifier consists of diodes CR3 and CR4, which function as a peak-reading full-wave detector. Diodes CR1 and CR2 clamp the signal to ground, thereby assuring a stable reference level, regardless of input signal duty cycle. The detected voltage appearing across capacitor C6 is proportional to the peak voltage of the input signal. A portion of this positive voltage is tapped by the Pulse Width control, variable resistor R20, and fed to the base of emitter follower Q7, part of the pulse shaper and control stage.

5.134 PULSE SHAPER AND CONTROL. Emitter followers Q7 and Q10, differential amplifier Q8, Q9, and Pulse Width control R20 make up the pulse shaper and control stage.

Emitter follower Q10 matches negative pulses from Q6 to the base of Q9 and emitter follower Q7 matches the negative d-c voltage tapped by R20 from the full-wave rectifier output to the base of Q8. With no input applied, Q8 and Q9 are biased to saturation. Negative-going pulses to the base of Q9 drive it below saturation, producing positive pulses from the Q9 collector. The clipping level at which the base input overcomes saturation of Q9 is determined by two factors. The first is the setting of R20. Pulse width control by R20 depends upon the data pulse rise and decay times. Typically, width can be varied approximately 2 microseconds. The second factor is the peak amplitude of the input waveform to the record amplifier. The negative voltage to the base of Q8 increases with data pulse amplitude, reducing collector current through Q8 and driving Q9 farther into saturation. This increases the negative voltage that is required to drive Q9 below saturation, thus clipping the input waveform at about the same percentage of amplitude, whatever amplitude may be. Hence, regardless of input amplitude, width of the Q9 collector output pulse remains essentially constant. At the same time that Q9 is driven below saturation, its emitter is pulsed negative. This negative pulse is coupled to Q8, which amplifies it without inversion. The positive pulse from the Q9 collector and the negative pulse from the Q8 collector, produced for each negative base input pulse that drives Q9 below saturation, are differentiated and applied to the bistable multivibrator.

5.135 MULTIVIBRATOR. The sharp rectangular waveshapes produced by differential amplifier Q8, Q9 are differentiated and fed to Q11 and Q12 which, with related circuit elements, form a bistable multivibrator. The multivibrator provides a large voltage swing and further sharpens rise and decay times. Jumper plug P1 may be used to select either of the complementary outputs from the multivibrator; it thus permits polarity inversion in the recording system, as listed in table 5-4.

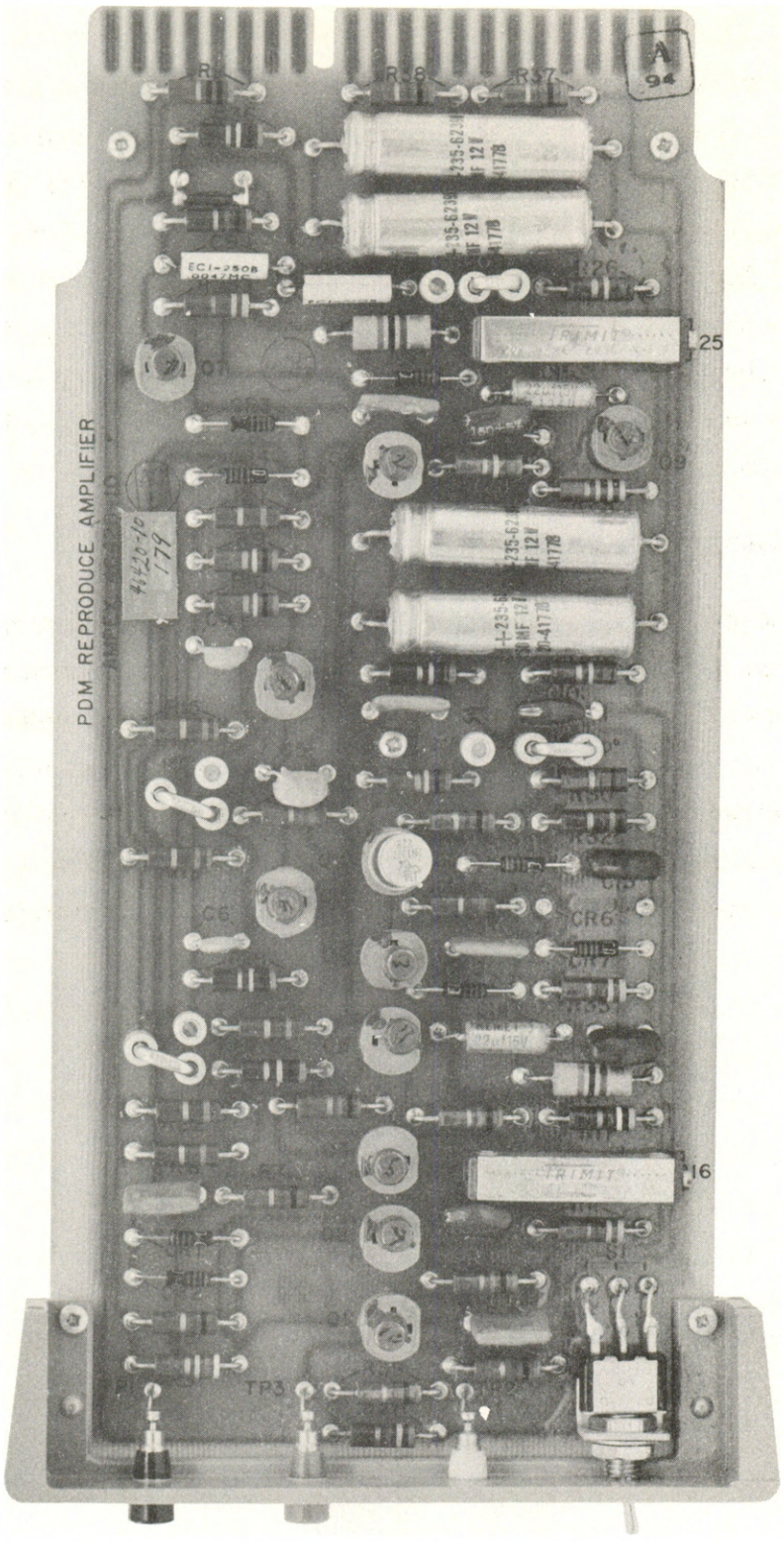
Table 5-4. PDM Record Jumper Plug Input/Output Configuration

INPUT POLARITY	P1 CONNECTION	OUTPUT POLARITY
+	0°	+
+	180°	-
-	180°	+
-	0°	-

5.136 DRIVER. The output of the multivibrator is fed to a differentiating network, R34 and C12. The differentiated pulses at the leading and trailing edges of the multivibrator output pulse are coupled directly to the bases of emitter followers Q13 and Q14, which form a complementary-symmetry push-pull driver stage. The emitter load of this driver stage consists of resistors R35 and R36, variable resistor R37, capacitor C15, and the winding of the record head. Potentiometer R37 is used to set peak record current at 17.5 milliamperes for both positive and negative directions of current flow. Capacitor C15 blocks direct current, thereby preventing head magnetization. The pulse amplifier stages are supplied power from separate positive and negative 12 volt lines. These lines are decoupled to keep noise from the power supply and other circuits.

5.137 PDM REPRODUCE AMPLIFIER

5.138 The reproduce amplifier (see Figure 5-19) for pulse-duration-modulated data contains circuitry that reconstructs the original pulse fed into the record system. During the reproduce process, the reproduce head winding differentiates the spike pulses into a waveshape that is somewhat rounded and less peaked. These rounded pulses are then used to trigger the reconstruction circuitry of the reproduce amplifier. The circuitry of the PDM Reproduce Amplifier (see block diagram, Figure 5-20 and schematic Figure 8-13) consists of an input amplifier, differential amplifier, bistable multivibrator, driver, output



8437-10

Figure 5-19 Typical PDM Reproduce Amplifier

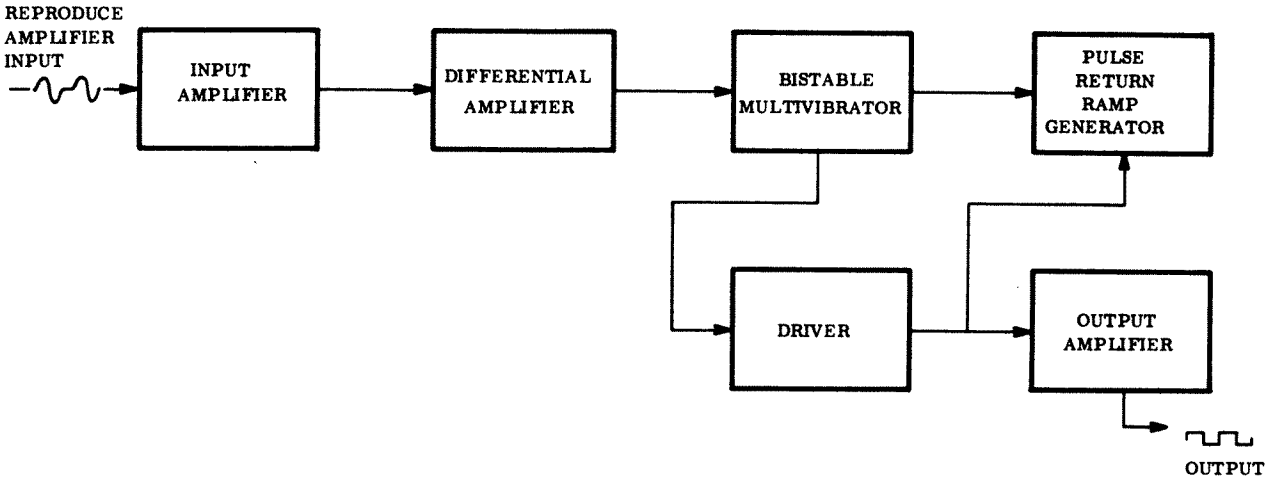


Figure 5-20 Block Diagram, PDM Reproduce Amplifier

amplifier and a pulse return ramp generator. The preceding circuits will be considered separately in the following descriptions.

5.139 INPUT AMPLIFIER. The input pulse is applied at pin F through a series resistor to switch S1 which changes the gain of the amplifier when the Tape Transport is operating at different tape speeds. The switch has two positions, one of which routes pulses through resistor R2, preventing the amplifier from being overdriven at the 60 and 30 ips speeds. The other position of S1 bypasses R2 since no attenuation is necessary at the 15 and 7-1/2 ips tape speeds. The change in gain between the two positions of S1 is approximately 2:1.

5.140 The pulse is then coupled through capacitor C1 to the base of transistor Q1, which develops an amplified signal potential across resistor R3. The signal is again amplified by transistor Q2, the second half of a pair of linear feedback amplifiers.

5.141 The output of amplifier Q2 is fed through diodes CR1 and CR2, which provides slight clipping action from the signal base line. Data pulses leaving the diodes are coupled through capacitor C3 to the base of transistor Q3, one-half of a differential amplifier.

5.142 DIFFERENTIAL AMPLIFIER. Transistors Q3 and Q6 form the differential amplifier. The input pulse is applied at the base of Q3 and amplified. By sharing a common

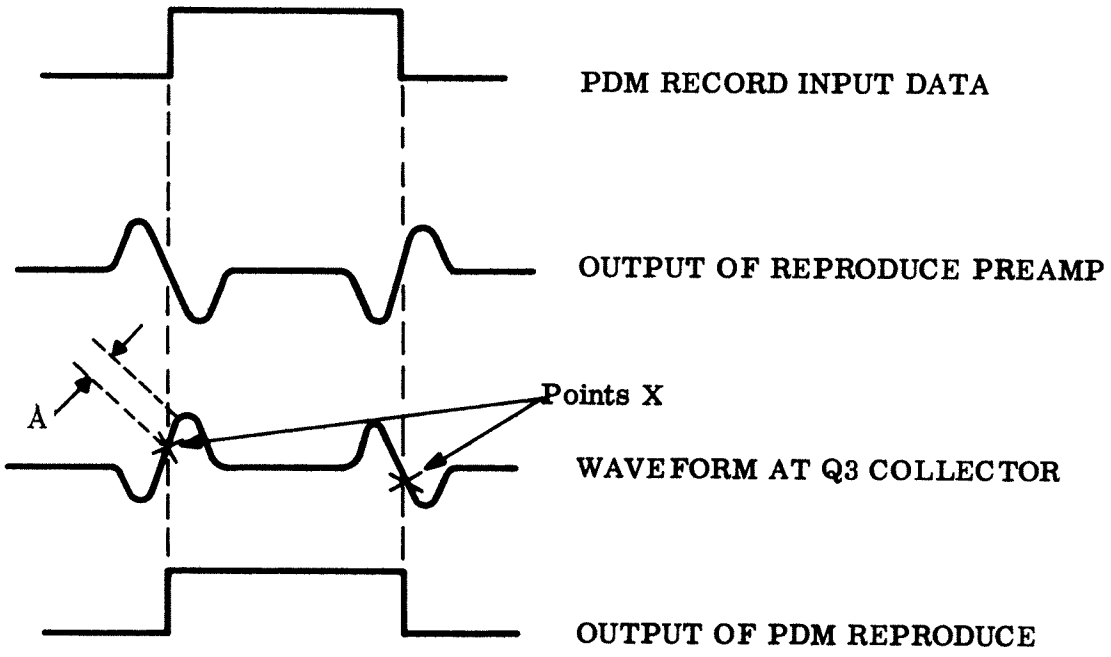


Figure 5-21 Idealized Waveforms

emitter resistor R17, Q6 also receives this pulse and amplifies it 180° out of phase with respect to Q3. Data logic is restored by the voltage passing through zero thus causing switching of the bistable multivibrator at points X. (See Figure 5-21.) The outputs of transistors Q3 and Q6 are fed to a multivibrator through resistors R9 and R20 respectively.

5.143 Resistor R16 controls the differential amplifier balance so that switching of the bistable multivibrator is symmetrical about the signal base line. The adjustment range of R16 is approximately that of "A" in Figure 5-21.

5.144 BISTABLE MULTIVIBRATOR. The bistable multivibrator reconstructs the recorded waveform into a rectangular pulse comparable to the original pulse applied to the record amplifier. A positive-going voltage, (point X, see Figure 5-21), from the collector of Q3 causes transistor Q4 to saturate thereby producing a negative voltage at its collector. The operation of transistor Q5 is the reverse of Q4, thereby producing a positive voltage at its collector. This operation produces a positive-going output waveform at the base of Q9 whenever the input pulse is positive and all jumper plugs are in the 0° position. A negative output polarity can be achieved by placing the jumper plugs to the positions shown in Table 5-5. The multivibrator is automatically reset by the pulse return circuit should loss of the second half of the input pulse occur.

Table 5-5 PDM Reproduce Jumper Plug Input-Output Configurations

	P1	P2	P3	
+	0°	0°	0°	+
+	0°	180°	180°	-
-	180°	180°	0°	+
-	180°	0°	180°	-

INPUT OUTPUT

5.145 DRIVER . The rectangular pulse from the bistable multivibrator is coupled through resistor-capacitor network R28 and C12 to the base of transistor Q9. The transistor is a saturating amplifier which switches between 0 and +12 volts. This switched voltage alternately drives the output transistors Q10 and Q11.

5.146 OUTPUT AMPLIFIER. The rectangular pulse from the driver Q9 is coupled to the base of Q10 through resistor-capacitor network R32 and C15 and to the base of Q11 through CR6, CR7 and resistor capacitor network R33 and C16. Zener diodes CR6 and CR7 keep Q11 from conducting while the signal is at 0 volt. As the pulse suddenly goes positive, the zener diodes conduct saturating Q11. The alternate switching of Q10 and Q11 produces a switched voltage at the collectors that goes from +12 volts to -12 volts. This voltage is capacitively coupled by C18, C19, C20 and C21 to the output pin "L". This output pulse has a minimum amplitude of 20 volts when loaded with a minimum of 1000 ohms. The output impedance of the PDM reproduce amplifier is 100 ohms or less.

5.147 AUTOMATIC PULSE RETURN CIRCUIT. Tape "drop-outs" could occur if the tape is accidentally moved away from the reproduce heads by dust particles. The OFF-signal pulse might not be detected by the reproduce head, and if no provisions are made, the output of the amplifier would continue beyond the end of the maximum expected pulse duration. At the desired pulse-return setting, the circuit then provides the missing OFF-pulse.

5.148 For a maximum pulse-duration setting of 700 microseconds, its pulse return circuit would also be set at 700 microseconds. If, for instance, a 100-microsecond pulse has been recorded on the tape, but the OFF-pulse has dropped out, the reproduce output with pulse return circuit would be 700 microseconds. Without a pulse return circuit the wave-

form of the next data pulse would first reset the multivibrator and with the same ON-pulse, start the new data in the proper phase. The pulse return is useless if the ON-pulse is dropped out, however, proper circuit operation is restored by a reset ON-pulse just before the normal OFF-pulse.

5.149 Negative-going pulses are fed through R27 from the output of the driver Q9 (for a positive-going output) or from the collector of the output amplifier Q10 and Q11 (for a negative-going output) to the base of transistor Q8. This negative potential cuts off transistor Q8 allowing capacitors C8 and C9 to charge at a rate determined by resistors R26 and the PULSE RETURN adjust resistor R25. (For a shorter pulse return period, jumper plug P4 should be placed in the a-c position.) These components comprise a voltage generator that produces a linearly rising voltage that is applied to the base of transistor Q7, an emitter follower. The voltage on the emitter builds up at the same rate as that applied to the base. This voltage, upon exceeding approximately 4 volts, forces a change of state to either Q4 or Q5 which resets the bistable multivibrator. The forward-voltage drop of CR3 and CR4 provides isolation between the bistable multivibrator and the pulse return circuitry.

5.150 The reset circuit is designed for a greater time duration than that of the duration of a normal signal pulse. A normal maximum pulse width is 900 microseconds (IRIG), and the time constant of the ramp potential generator is adjusted in the Ampex laboratories for 2500 microseconds, allowing a sufficient margin between the end of a long pulse and the point of automatic reset. The pulse-return time duration can be adjusted between 100 and 10,000 microseconds in two ranges by moving jumper plug P4.

5.151 REPRODUCE PREAMPLIFIER

5.152 The reproduce preamplifier is used to amplify a channel signal from the reproduce head before it is presented to the reproduce amplifier, thus allowing longer head cables than would otherwise be practical. The reproduce preamplifier, which does not incorporate equalization, is used with all reproducing techniques. The preamplifiers (3 and 4 to a card) are contained on plug-in cards which mount in the preamplifier housing located on the underside of the Tape Transport. Figure 5-22 shows the location of each preamplifier and the number of the channel to which it connects. Power for the operation of the preamplifiers is provided from the ±12 volts d-c power supply via a decoupling network located beneath the transport overlay plate. An input signal to a preamplifier from a reproduce head varies

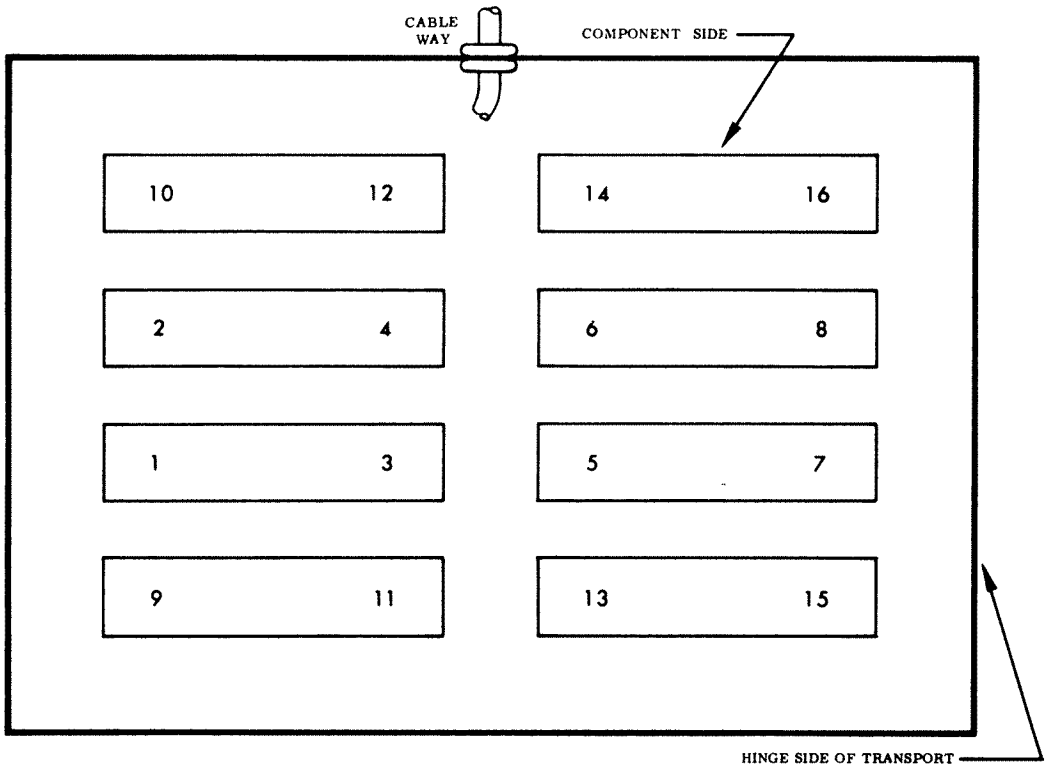


Figure 5-22 Preamplifier Channel Numbering

between several microvolts and 1 millivolt, depending on tape speed and frequency.

5.153 Each reproduce preamplifier is a three-stage unit, utilizing a transistor, Q1, in a common collector configuration at the input, followed by two common emitter stages, See schematic, Figure 8-14.

5.154 The incoming signal is applied to the base of the emitter follower stage Q1. Resistor R1 across the input to ground, is used to flatten out the peak resulting from the resonance of the head inductance and the head cable capacitance. The collector voltage of Q1 is obtained from a divider consisting of R2 and R5, bypassed by C2. The output of Q1 is taken from the junction of R3 and R4.

5.155 Transistors Q2 and Q3 act as a two-stage feedback amplifier; the feedback signal is taken across the output through R10 and C4. The feedback ratio is determined by the ratio of R10, R7 and the active part of R8. The gain of the amplifier is controlled by varying the amount of resistance in the emitter circuit of Q2 by adjusting R8; this acts both to decrease the gain of Q2 and to increase the feedback ratio from the output. The emitter current of Q2 is supplied by R9. The gain of the amplifier is variable by means of R8 from a maximum of 43 db down to approximately 36 db.

5.156 The use of an emitter follower input stage results in decreased loading on the reproduce head which might otherwise result from the input capacitance of Q1. The collector of Q1 is bypassed by C2, thus reducing the effect of collector-to-base capacitance.

5.157 POWER SUPPLIES

5.158 CAPSTAN DRIVE INVERTER

5.159 The Capstan Drive Inverter (Motor Drive Amplifier-MDA) is a crystal-controlled power oscillator capable of supplying 35 watts at 115 volts, regulated to ±2% with a frequency stability tolerance of ±0.01%. The unit is designed to provide power for hysteresis synchronous motors, and incorporates rate feedback to prevent hunting against motor "lock-in" current and power factor variations. The inverter circuitry is shown in schematic, Figure 8-15.

5.150 STABLE FREQUENCY SOURCE AND FREQUENCY DIVIDERS. A precise source of 60 cps is derived by dividing the output of a 7.680 kc crystal oscillator by a factor of 128 using a chain of seven consecutive binary divider stages. The crystal oscillator utilizes a series ground J-cut crystal in an emitter coupled positive feedback amplifier, Q1-Q2.

5.161 The output of the oscillator is fed through C4 to the first binary divider Q3-Q4, with a square wave output of 3.840 kc, The succeeding six binary stages are identical to the first, with the exception that the commutated clamping resistors between the collectors and the input differentiating capacitors on each side of the binary are increased in value as the frequency decreases.

5.162 The output of the last binary divider, Q23-Q24, is coupled through an isolating impedance R86 to pin F of P18, the INPUT/OUTPUT connector. The signal at pin F is a 60-cps square wave with a nominal amplitude of 14 volts peak-to-peak and is made available as a standard frequency output. Maximum allowable load is 5000 ohms, shunted by 100 pF.

5.163 OUTPUT VOLTAGE REGULATOR. The output voltage regulator is a negative peak clipping modulator Q7 driven by Q8. The emitter potential of Q8 determines the minimum level to which the emitter of Q7 will be allowed to fall. Input to the modulator is brought from pin H of P18 so that the output power may be derived from the internal standard frequency by cross-coupling pins F and H of P18.

5.164 A 60-cps band pass filter composed of L1, C15, L2 and C16, is driven from the emitter of Q7. Transistor Q9 is an emitter follower amplifier used to drive Q12 the power amplifier driver transistor, which is also an emitter follower. The secondary of T1 drives the bases of Q13 and Q14, operating as a common emitter push-pull power amplifier.

5.165 Collector load is matched from the output load through T2, the output transformer. A feedback winding on the output transformer, provides approximately 28 volts rms, in direct ratio to the voltage across the load at pins D and E of P18, the output power terminations. The output of the feedback windings is full-wave rectified by CR9 and CR10 and integrated by C24. The d-c voltage thus obtained at the cathodes of the diodes will vary in direct ratio to the load rms value. Scaling resistors R35 and R37 are used to bring the center position of the potentiometer R36 to a nominal 10 volts d-c, which is approximately equivalent to the zener voltage of CR8. In addition, adjustment resolution becomes very high since the total range of the output voltage adjustment potentiometer R36 is capable of changing the output voltage only 5% from the nominal output voltage of 115 volts. R36 is a 20-turn potentiometer, allowing an output voltage adjustment resolution of approximately 0.5% per turn.

5.166 REGULATOR ACTION. Assuming that either the load impedance at the output or the supply voltage has increased, the output would have a tendency to increase. As the output voltage increases, the base of Q11 will go positive. The emitter of Q11 is clamped at +10 volts by the reference zener diode CR8 and an increase in base voltage will therefore cause the collector to go negative. The collector of Q11 is directly coupled to the base of Q10, a common emitter PNP amplifier whose collector will now travel in the positive direction due to its base being pulled negative by the collector of Q11. The collector of Q10 is coupled to the base of Q8 through R29 and disconnect diode CR7. R29 and C18 form an integrator network used to prevent regulation overshoot. Q8 is an emitter follower whose base is driven positive effectively clamping the minimum level to which the input emitter follower Q7, sharing the same emitter load resistor R24, will be allowed to fall. Effective rate feedback is obtained from C23, shunting R35 and the portion of R36 above the arm.

5.167. OVERLOAD AND SHORT CIRCUIT PROTECTION. A current transformer T3 is placed in series with the load. The voltage of the secondary of T3 is directly proportional to the load. This voltage is full-wave rectified by diodes CR11 and CR12 and applied to the base of Q29 operating as a common emitter amplifier. The waveform at the base of Q29 is

a 60-cps half-sinusoid occurring at 120 pps. The emitter of Q29 is biased in the positive direction by the overload CUT-OFF THRESHOLD adjustment potentiometer R102. The +5 volts bias at the emitter of Q29 is approximately equal to the peak positive pulse amplitude at the base when the load on the power amplifier approaches 40 watts. Any increase in the power amplifier load above the 40-watt level will cause the peak positive excursion of the pulses at the base to exceed the emitter bias level. This will cause the collector to go negative, consequently pulling the collector of Q28, one side of a binary, negatively through the disconnect diode CR25. The binary, composed of Q27 and Q28, becomes unbalanced and through its instability gain switches rapidly into the condition where the collector of Q27 goes positive. The positive excursion at the collector of Q27 runs from approximately 3 to 18 volts. The disconnect diode CR6, applies +17 volts to the base of Q8 and effectively gates off the modulator, reducing power amplifier drive to zero. Under these circumstances, an output overload or short circuit will not damage the power amplifier as the power transistors, Q13 and Q14, are not conducting.

5.168 The function of disconnect diode CR7 is to prevent the integration of the overload turn-off gate by the feedback loop integrating capacitor C18. Disconnect diode CR6 prevents loading of the modulator bias level at the base of Q8 by the collector impedance of Q27 when the overload gate binary is in its reset position. Reset of the gate binary is accomplished by a 0.5 cps free-running multivibrator, Q25-Q26.

5.169 Assuming an overload condition has occurred, the overload gate binary will rapidly reduce power amplifier drive to zero. As long as the overload condition continues, the circuit will sample the load every two seconds and reset itself on the first trigger from the free-running multivibrator following the removal of the overload.

5.170 ADDITIONAL PROTECTION FEATURES. Cross polarity protection is accomplished by a silicon power diode CR14. Transient over-voltage protection is provided by a power zener diode, CR13 which limits the maximum supply voltage to all small signal transistors to a maximum of 22 volts. Excess temperature protection is provided by a snap-action action thermostat TS1, placed in series with the primary of the driver transformer T1. TS1 is adjusted to open when the temperature rises above a nominal value of 165°F.

5.171 POWER CONTROL CASE

5.172 The power control case performs all necessary switching functions to operate the CP-100 system from a variety of prime power sources. In addition to the necessary

switching logic, the power control case contains a DC-AC inverter used to operate the CP-100 system cooling fans, a transistorized error-detector/magnetic-amplifier-regulator driver which operates in conjunction with the Primary Power Supply and a low impedance, low pass filter used to remove noise from external d-c sources.

5.173 Through the switching of two logic plugs it is possible to operate the system from any one of five different power sources. The plug switching technique makes it possible to route large quantities of current through many circuits, while using 1/20 or less of the volume which would otherwise be required by a number of large relays (or a rotary switch containing a sufficient number of poles, positions and contact current capability).

5.174 The basic function of the power control case is to perform circuit switching as necessary to allow the CP-100 system to operate from 50/60 cycles, 110 or 220 volts or from 380/420 cycles, 110 or 220 volts, and from 28 volts d-c (see schematic, Figure 8-16). The five modes of operation are discussed individually in the following paragraphs.

5.175 50/60 CPS OPERATION, 110 V NOMINAL LINE VOLTAGE

1. The primary windings of the Primary Power Supply are connected in full parallel.
2. The line power is coupled directly to the capstan motor, by replacing the Motor Drive Amplifier with an MDA jumper plug.
3. The fans are connected directly to power line.
4. D-c power is removed from the fan inverter.

5.176 50/60 CPS OPERATION, 220 V NOMINAL LINE VOLTAGE

1. The primary windings of the Primary Power Supply are connected in full series.
2. The line power is coupled directly to the capstan motor, by replacing the Motor Drive Amplifier with an MDA jumper plug. The MDA power is obtained from the upper half of the primary power transformer (primary winding connection).

3. The fans are connected across the lower primary power supply (primary winding) to provide a 110-volt source from auto-transformer action.
4. D-c power is removed from the fan inverter.

5.177 380/420 CPS OPERATION, 110V NOMINAL LINE VOLTAGE

1. The primary windings of the Primary Power Supply are connected in tapped parallel.
2. The line power circuit is removed from the MDA plug.
3. The fans are connected to the output of the fan inverters.
4. D-c power is applied to the fan inverter circuit.

5.178 380/420 CPS OPERATION, 220V NOMINAL LINE VOLTAGE

1. The primary windings of the Primary Power Supply are connected in tapped series.
2. The line power circuit is removed from the MDA plug.
3. The fans are connected to the output of the fan inverter.
4. D-c power is applied to the fan inverter.

5.179 28-VOLTS D-C OPERATION

1. The primary windings of the Primary Power Supply are opened from any possible source of power.
2. The MDA plug is disconnected from any possible source of line power.
3. The fans are connected to the output of the fan inverter.
4. D-c power is applied to the fan inverter.

5.180 D-C POWER CONTROL RELAY. Relay K1, contained in the power control case, is used to switch the heavy current required by the transport, the MDA and Electronics Power Supplies and the fan inverter. The CP-100 POWER on/off switch completes the circuit to operate the coil of K1.

5.181 ERROR DETECTOR MAGNETIC AMPLIFIER REGULATOR DRIVER CIRCUIT. Zener reference diode, CR1, establishes reference voltage of 10 volts d-c at the emitter of Q3. The base of Q3 samples the output of the magnetic amplifier regulator. The

collector current of Q3 is directly proportional to the output voltage of the magnetic amplifier regulator. The collector current of Q4, a common emitter amplifier driven by Q3, operates the control windings of the magnetic amplifier, causing the saturable reactors to gate off whatever portion of the input power cycle necessary to maintain a regulated d-c output voltage. Adjust potentiometer R5 for d-c output voltage (nominally 27.5V d-c).

5.182 FAN INVERTER CIRCUIT. The fan inverter is a common emitter, free-running multivibrator, composed of Q1, Q2, T1 and the bias network R10, R11 and C4. The operating frequency of the fan inverter is nominally 60 cps. This frequency varies in a direct percentage ratio to the input d-c voltage.

5.183 ELECTRONICS POWER SUPPLY

5.184 The electronics power supply is a dual output, highly stable source of power capable of providing two independent sources of 12 volts d-c at a maximum current drain of 1.5 amperes each. Regulation of the two outputs is ±0.2% for the combined effects of input voltage, load current, and temperature variations (see schematic, Figure 8-17). Both the electrical and mechanical features of the unit have been designed to assure virtually non-existent stray magnetic fields, and output ripple values in the microvolt range. Additional circuitry provides for a completely fail-safe reaction to an output short circuit, overload, input overvoltage transients, or cross polarity.

5.185 As a further safeguard of optimum overall CP-100 system performance, special circuits maintain output-voltage symmetry despite function switching through RECORD/STOP/REPRODUCE mode selections. The equipment will always produce a symmetrical output despite the overload or short circuit of either or both of the outputs. It should be noted that the circuit is composed of five basic sections:

a) DC-DC Power Conversion and Filtering
b) Regulators
c) RECORD/STOP function Gating Circuitry
d) Overload Protection
e) Overvoltage and Cross Polarity Protection.

5.186 DC-DC POWER CONVERTER AND FILTER. To produce two independent voltages from a single, nominal 28-volt d-c source, the input power is converted by a free-

running high power chopper composed of Q1, Q2, and T1. Converter efficiency is optimized through the use of low saturation power transistors and a transformer core (T1), having a substantially rectangular B-H characteristic. The core of T1 is a non-gapped, tape wound toroidal structure which lends itself not only to optimum efficiency, but assures that the stray magnetic fields produced by the transformer will be approximately equal to the field developed by one turn. With a nominal input of 28 volts d-c, the voltages at the secondary of T1 will be a 1.7 kc square wave having a peak-to-peak value of 34 volts and a rise and decay time of approximately 2 microseconds each.

5.187 Silicon diodes CR5 thru CR8 accomplish full-wave rectification for the input to the two 1.5-ampere regulators. Silicon diodes CR3, CR4, CR9 and CR10 accomplish full-wave rectification of a 5-volt bias source required by the regulators.

5.188 DC-DC converters of this nature owe their efficiency to the very short interval between the cutoff and saturation points of the transistors and the fact that the core of the converter transformer has a rectangular characteristic and is being driven to saturation at approximately 15 KC levels. Such operation results in switching transients containing extremely high energy millimicrosecond-ringing during the interval between the cutoff and saturation. This ringing may run several hundred cps before it is self-damped to zero. The noise problem of DC-DC converters is further complicated by the cutoff time of silicon power diodes, which under high junction temperature conditions will substantially exceed the turn-on time for the same type of diode. In the case of high speed rise and decay square-wave converters, this turn-off to turn-on time differential may well exceed the reverse-cycle switching duration of the converter, causing a momentary short circuit from the standpoint of the converter transistors, Q1 and Q2. This diode characteristic causes a tremendous amount of "Hash" both at the input (backup hash) and at the output (output hash) of the converter. This switching transient (momentary short circuit), also occurs in the power transistors, the effect on output noise also being more pronounced as junction temperatures are increased. Where such converters are used to supply power to electronic circuitry having broadband capability, this hash must be completely removed from both input and output lines.

5.189 Backup-hash filtering is accomplished by a symmetrical transmission-line type filter using magnetically-isolated pi-section filters coupled by bulkhead feed capacitors. The output hash is similarly filtered and the output d-c voltages are applied to the regulators through the feedthrough capacitors C62 thru C67. Input voltage to the converter is applied at C1 and C2.

5.190 REGULATORS. Since the two regulators and their cutoff binaries are identical, only the "A" section regulator will be considered in this discussion. Input to the regulator is applied in the following manner. Minus common enters the regulator from capacitor C64. The +17 volts d-c nominal with a capability of 1.5 amperes is applied from C63 and +22 volts d-c nominal with a capability of 35 milliamperes is applied from C62. The 17 volts d-c is applied to the emitter of the series regulator power transistor Q3, through the load sensing resistor, R17. At the collector of Q3, the regulated output voltage is sampled by the difference amplifier, Q16, through the scaling network of R59, R57 and the OUTPUT-VOLTAGE adjustment potentiometer, R58. The difference amplifier, Q16, is composed of silicon transistor and two zener diodes connected back-to-back. The three elements are constructed as an encapsulated four-terminal device, the temperature coefficient of the three junctions being selected in such a manner that a fixed collector current will result, (from a fixed base voltage) within a tracking accuracy of .02% per C° over a broad temperature range.

5.191 The zener reference at the emitter of Q16 is nominally 8 volts and varies as a function of temperature in the reverse direction and equal in magnitude to the base emitter junction. As a means of further improving temperature stability, a thermistor tracking network composed of R52B and R53B is paralleled across the positive half of the error sampling network, in the event that the difference amplifier exhibits a negative temperature coefficient. Should the difference amplifier have a positive temperature coefficient, the thermistor tracking network would be transposed to the negative half of the error-sampling network and the network would have schematic reference designation R52A and R53A.

5.192 REGULATOR ACTION. Assuming that the input voltage has increased or the load current has decreased, the output voltage would have a tendency to go positive, causing the positive differential between the base and emitter of Q16 to increase. The collector of Q16 will then go negative. The base of Q14, an emitter follower, directly coupled to the collector of Q16 will run negative and consequently the emitter of Q14 will run negative. The emitter of Q14 is coupled to the base of Q12 through CR22, an 8-volt zener diode, used to provide a larger emitter-collector differential for Q12 in order to obtain higher gain. As the cathode of CR22 goes negative so does its anode and the positive bias on the base of Q12 is reduced. This in turn reduces the collector current of Q12 which will now reduce the forward-bias on the base of Q10, an emitter follower. Q10 will draw less base current at Q3, the series regulator power transistor, and cause Q3 to increase its emitter collector junction resistance so that the output voltage is dropped back to its required value.

5.193 The series regulator must be capable of being reliable and rapidly gated into a completely non-conducting state. The requirement for such gating may result from one of two causes. (1) The regulators may be under a condition of overload or short citcuit. (2) The regulator may be under the condition of being gated into the non-conducting state for a period of time required for both the plus and minus 12-volt contacts of the RECORD relay to close firmly before the two outputs are again gated on. The necessity for and the means of obtaining these modes of operation are discussed in detail in the sections dealing with gating circuitry and overload protection (paragraphs 5.197 through 5.209). Because of this requirement, the regulator has no provision for inherent forward bias, An external starting circuit capable of operating in terms of and/or logic in conjunction with the gate off circuit is used. The operation of the starting circuit is as follows:

5.194 The 22 volt bias supply provides a relatively constant current to a 10.5 volts zener diode CR20, through R31, and a forward conducting silicon diode CR18. The purpose of CR18 is to counteract the zener voltage variation of CR20 as a function of temperature. The fixed bias voltage thus obtained at the anode of CR18 is approximately 11 volts. This 11-volt bias is applied through the disconnect diode, CR16, to the collector of Q14, the collector load resistor of Q16 and the reference zener through the constant current resistor R47. After initial turn on, Q3 will be cut off, and the voltage supplied through CR16 will cause Q16 to be completely cut off since its base will be approximately 8 volts negative, referenced to the emitter. This causes all other transistors including Q3 to conduct heavily. As the collector of Q3 rises positively through the 11-volt level supplied by CR16, the cathode of CR15 will reach the same potential as the cathode of CR16. As the collector of Q3 continues to rise, CR16 will cease to conduct and the collector of Q14, the collector load of Q16 and the zener reference will now be supplied by a slightly higher potential through CR15.

5.195 To minimize the output resistance of the regulator, a positive feedback loop is incorporated which has the effect of giving the error amplifier infinite gain to correct for load variations. Positive feedback is obtained by placing a resistor R45, in series with the negative side of the load. The load side of R45 is junctioned to the zener diode so that the zener at all times will be referenced to the negative side of the load. An OUTPUT IMPEDANCE adjustment potentiometer R44, is placed across R45 and supplies only a portion of the voltage dropped across R45 to the negative end of the error sampling network. This circuit arrangement makes a load increase appear as an output voltage decrease from the standpoint of the difference amplifier Q16. Operational range of the OUTPUT IMPEDANCE adjustment potentiometer is such that the output impedance can be adjusted to make the power supply

appear as having an adjustable output impedance ranging from negative, through zero to positive. Careful adjustment of R44 will make the regulator appear as having virtually zero output impedance.

5.196 RECORD/STOP FUNCTION GATE CIRCUITRY. The record electronics are balanced amplifiers operated by ±12 volts d-c. When the system is switched from any function into the RECORD mode or from the RECORD mode to any other function, the ±12 volts power must be applied or removed simultaneously to preclude the possibility of magnetizing the recording heads due to unbalanced supply voltages supplied to the record electronics. Since the ±12 volts electronics supply is normally operating and supplying power to various portions of the system other than record electronics, a self-latching relay is used to apply ±12 volts d-c to the record electronics upon actuation of the RECORD button. Power transfer relays normally do not switch all contacts simultaneously, furthermore, the contacts have a tendency to bounce, producing an erratic contact closure of several milliseconds duration, in addition to a closure time differential of one to two milliseconds between the two sets of contacts. To prevent a steady state d-c unbalance in the record heads due to the inherent characteristics of mechanical relays, special circuitry has been incorporated in the ±12 volts Power Supply which operates in the following sequence:

a) Upon actuation of the RECORD button, both the ±12 volts outputs are gated OFF and a 35-millisecond delay multivibrator is triggered into a running condition.
b) At the completion of the 35-millisecond interval, the ±12 volts outputs are gated ON simultaneously, the 35-millisecond delay duration being sufficient to allow the RECORD POWER control relay to close firmly.
c) Approximately 4 milliseconds following the ON gating of the ±12 volts outputs a step function gate is provided to ensure that the oscillator of all FM record electronics will be forced into oscillation.

5.197 GATING CIRCUIT LOGIC. One side of the RECORD POWER relay coil is returned to +28 volts d-c at all times, the other side of the coil is connected to ground upon actuation of the RECORD button. When the RECORD button is actuated the negative end of the record relay coil produces a 28 volts negative-going step function which is applied at the "RECORD TRIGGER IN" terminal, Pin K of P20. A silicon diode, CR35, is connected in a non-conducting direction between Pin K and a +28 VOLTS D-C INPUT pin A to prevent

The high voltage backlash (resulting from the removal of power at the record relay coil) from damaging circuit components related to the gating system. The incoming negative step function is applied at the cathode of CR31 causing the anode to run negative charging C99 to a higher potential, simultaneously changing the base voltage of Q26 from cutoff bias to saturation. When Q26 saturatess its collector runs positive and remains positive for such time as the RECORD relay is closed. The leading edge of the positive step function at the collector of Q26 is differentiated by C98 and R90, applying a positive pulse through CR28 to the trigger input base of a 35-millisecond delay multivibrator composed of Q23 and Q24.

5.198 When power is removed from the RECORD relay, the potential at pin K is a 28 volts positive-going step function. The cathode of CR31 will now be more positive than its anode due to the residual charge in C99. CR31 is now cutoff and C99 begins to discharge through its parallel resistance path, R93 plus R92, causing the base of Q26 to arrive at cutoff bias when C99 is discharged. At this time the collector of Q26 will go negative, and will remain negative for such time as the RECORD relay is de-energized. The leading edge of the negative step function, at the collector of Q26 is differentiated, by C97 and R89, resulting in a negative pulse at the base of Q25. Transistor Q25 is normally saturated due to the base current supplied by the forward-bias resistor R89. When Q25 is cut off by the negative pulse at the base, it produces a positive pulse at the collector which is differentiated by C96 and R87 and applied through CR27 to the input base of the delay multivibrator.

5.199 The preceding information indicates that the transfer of the RECORD relay into either position will result in a 35-millisecond gate at the output of the delay multivibrator. The complexity of the delay multivibrator triggering circuitry is required because it is possible to force-reset a delay multivibrator by hard successive triggering either positively or negatively prior to inherent delay time expiration. Such successive triggering is generated in abundance by the bouncing of the RECORD and STOP button contacts, the resulting noise problem is then further aggravated due to the inductive nature of the load, i.e., relay armature coil.

5.200 The delay multivibrator is biased so that in its quiescent condition Q24 is cut off and Q23 is saturated. At this time, the collector of Q23 is at +4 volts. During the running time, the collector of Q23 is cut off and the 22-volt regulated source, from the zener diode CR2, is applied to the cathode of the 10-volt zener diode CR25, and will pull the base of Q20 (one side of the regulator gate off binary composed of Q18 and Q20) to +7 volts, causing the

Q20 side of the binary to conduct. The collector of Q20 drops from a normal value of +16 volts to a prime value of +4 volts, causing CR24 to conduct. This pulls the collector load of Q16 down to +4 volts. Since the coupling zener to the base of Q12 has a drop of 8 volts, it cuts off. No forward bias is applied to the base of Q12 and the "A" regulator is thereby completely cut off.

5.201 If the base of Q20 is pulled positive, the "A" section gate-off binary changes states rapidly, Q20 conducts and Q18 cuts off. The negative-going step at the Q20 collector is coupled through differentiating capacitor C78 and coupling capacitor C79 to the base of Q17. This signal cuts off Q17 and turns on Q19, the B section gate-off binary. This has the same affect on the "B" regulator output that turning on Q20 has on the "A" regulator output. Thus, both regulator sections are turned off within 2 microseconds of each other. The actual time that elapses before the two outputs reach zero volts depends upon the nature of the load and the period of time required for the external load circuits to discharge the internal filter capacitors, C85 through C88.

5.202 At the end of the 35 millisecond delay timing period of multivibrator Q23 and Q24, the collector of Q23 drops back to a +4-volt level. Zener diode CR25 now conducts in the forward direction as a normal diode with a voltage drop of approximately 0.45 volts. Thus, the base of Q20 is pulled negative to 4.45 volts. This cuts off Q20 and turns on Q18. With Q20 cut off, the "A" section regulator also turns on. As Q20 turns off, the leading edge of the 16 volt signal at its collector is differentiated by C78 and coupled through C79 to the base of Q17. This positive spike turns on Q17, which cuts off Q19. The cutoff of Q19 turns on the "B" section regulator. During the 35-millisecond delay, the record relay makes contact with both the plus and minus lines. At the end of the delay, plus and minus 12 volts is provided to the electronics without the disturbance that would otherwise be caused by the action of the relay.

5.203 A start trigger for the FM record oscillators is obtained from a miniature, (crystal can type), relay which closes when the "A" section output voltage goes positive through +10.5 volts d-c level. A 4-millisecond delay is obtained from the inherent closure time of the relay when actuated by a 21-volt d-c source applied across the armature due to the saturation of Q27.

5.204 Transistor Q27 is biased beyond cutoff by returning the base to ground through a low resistance R95, while the emitter is returned to ground through a forward conducting

silicon diode having a typical drop of 0.8 volt d-c. When the regulators are gated on, the "A" output voltage will rise to +12 volts causing the 10-volt zener diode CR32 to conduct and apply saturation forward-bias to the base of Q27 through the base current-limiting resistor R94. Consequently, Q27 will not begin to conduct until such time as the voltage at the cathode of CR23 exceeds the 10-volt characteristic drop plus the 0.8 volt back bias provided by CR34. Before the relay can close, the voltage at the cathode of CR32 must be sufficiently positive so that the voltage division between the base current-limiting resistor R94, and the cutoff bias resistor, R95, will be above a nominal value of 0.8 volt d-c.

5.205 The armature coil of the FM START OSCILLATOR relay K1, is returned to the +22 volt zener-regulated source from CR2, through a decoupling network composed of R96 and C100, to assure that the high current transients due to the inductive load do not inadvertently trigger any of the gating circuitry operating from the same collector source. A silicon diode CR33, is placed across the relay coil in a non-conducting direction to preclude the possibility of an inverse collector punch-through at Q27, due to the high reverse polarity voltage generated by the back-lash of the relay coil when Q27 is gated off.

5.206 OVERLOAD PROTECTION. Each regulator is protected by an overload fail-safe circuit. These circuits are identical in every respect; therefore, only the "A" section protection circuit, composed of Q6 and Q8, will be discussed.

5.207 Wirewound resistor R17 is used to sense output load current from the "A" section regulator. At the specified maximum load current of 1.5 amperes, a 0.75-volt drop is developed across R17. The current sense differential amplifier transistors, Q6 and Q8, are biased such that Q6 is normally cut off by an 0.8-volt (typical) offset bias that is applied to the base of Q8 from the Overload Trigger Threshold adjustment, potentiometer R15. This offset bias is overcome, and Q6 conducts, when load current of the regulator exceeds 1.65 amperes, raising the drop across R17 above 0.8 volt. Conduction through Q6 charges capacitor C69, in its collector circuit, positively through resistor R23. The time constant of R23 and C69 is long enough to prevent the overload circuit from triggering the regulator gate off circuit while the power supply filter capacitors and decoupling capacitors on the circuit modules are charging to the full supply voltage. The positive charge on C69 is coupled through diode CR12 to the base of off-trigger transistor Q20. When the applied potential triggers state reversal of binary Q20-Q18, the voltage from the collector of Q20 cuts off the "A" regulator output, as described in paragraph 5.200. At the same time, the negative

spike that is differentiated from the negative-going voltage at the Q20 collector turns off Q17, which turns on Q19. This "B" regulator gate-off action turns on transistor Q22, which starts the timing period of the 1-second monostable multivibrator that also includes transistor Q21. The timing of monostable multivibrator Q21-Q22 is set at 1 second by the circuit constants of C91 and R74. At the end of 1 second, this multivibrator reverts to its stable state, Q21 on and Q22 off. The negative-going pulse from the collector of Q21 turns off Q20 through capacitors C90 and C89, resetting the two regulator gate-off binaries to gate-on status. Both "A" and "B" regulators then supply their outputs. If the overload condition still exists, a new positive voltage is coupled to the base of Q20 through CR12 and the entire turn-off and turn-on action is repeated. So long as the overload condition persists, the 1 second monostable multivibrator, Q21-Q22, triggers repeated sampling of the output current at 1-second intervals. The regulators continue to turn off the regulator outputs until the overload condition causing excessive current drain from output regulator section "A" is corrected.

5.208 OVERVOLTAGE AND CROSS POLARITY PROTECTION. As the DC-DC converter section utilizes components specifically selected to withstand over-voltage transients of 40 volts peak, over-voltage protection requirements for this section are satisfied. Circuitry operated from the output of the DC-DC converter is protected in part by the downward transformation ratio of the converter and proper selection of components. The regulator circuit protects itself because the circuitry is supplied by its own regulated voltage.

5.209 The gate circuitry, composed of Q21 through Q27, requires a B+ supply in excess of 12 volts, so that the regulated output of the "A" section is not usable for this purpose. The gating circuits must therefore be operated from prime power and overvoltage protection is derived from the 22-volt power zener, CR2. Cross polarity protection is obtained from power diode CR1, which is placed between the input power connection, Pin A of P20 and all other circuitry.

5.210 PRIMARY POWER SUPPLY

5.211 The primary power supply is a magnetic amplifier regulator in a Ramey Bridge configuration. The unit is capable of accepting either 50/60 cps or 380/420 cps, 105 to 125 volts rms input, and provides 28 volts d-c regulated output, with a maximum capability of 8 amperes d-c (see schematic Figure 8-18). All magnetic components are non-gapped toroidal structures, shielded by mild steel cans to minimize stray magnetic fields.

5.212 The primary power transformer, T1, and the saturable reactors, T2 and T3, are ratioed to operate the saturable reactors near the center of tne B-H characteristic of the core, when the input frequency is 55 cps and the input voltage 115 volts rms. In this mode of operation, the full primary of T1 is utilized; for 380/420 cps operation T1 primary turns are reduced by using taps 2 and 5. This is necessary to increase the secondary voltage of T1 to a point where the saturable reactors will retain sufficient control range to provide the necessary regulator action despite the gate winding reactive drop increase. In the 380/420 cps operating mode the saturable reactors actually operate very close to the saturation point since at this frequency very little inductance is required to provide a substantial reactive drop.

5.213 The Ramey Bridge saturable reactor configuration lends itself ideally to this application in that a very small amount of power is required to reset the cores and the majority of the control current is provided in ratio to load demand by diode CR1 through CR4. Diode CR5 through CR8 are heavy duty silicon rectifiers arranged to produce full-

wave rectification of the output current of the magnetic amplifier, which is then integrated by C1 and C2. Control current for the magnetic amplifier which could be common to the output is brought in by a dry circuit of pins L and M to prevent output voltage errors due to wire losses. This precludes the possibility of output voltage variations as a function of cable harness length between the primary power supply and the power control case, where the transistorized error sensing and correction circuitry is located.

5.214 The primary power transformer T1, utilizes identical primary windings which may be connected in parallel or in series to provide for 115 or 230 volts operation, respectively. When the primary windings of T1 are connected in series for 230 operation the resultant center tap may be used in conjunction with either end of the winding as an auto-transformer to provide 115 volts rms at 30 watts to power the capstan motor, fan motors, or both. In the event that both the capstan motor and the fan motors are operated by the auto-transformer action of the two primary windings, the capstan motor is connected across the upper primary winding and the fan motors across the lower primary winding. The current unbalance in the primary windings is thereby minimized and optimum performance is realized from the regulator range capability of the unit.

5.215 BLOWER ASSEMBLY

5.216 The fan motor mounted in the case assembly, behind the air intake filter, supplies approximately 125 cfm of filtered air to the enclosed system. As shown in the schematic, Figure 8-2, the fan motor is a split-phase 60 cps, 115 volts induction motor wired to operate from a single phase source. A phase-splitting capacitor, C103, provides a 90° phase-shifted voltage to one winding.

5.217 Power factor correction capacitors, C101 and C102, prevent large inductive transients from damaging the transistorized fan inverter, as well as increasing the efficiency of the inverter by simulating an approximate resistive load. The fan inverter is a 60-cps square wave generator supplying power to the fan when the CP-100 system prime input power is 28 volts d-c or 400 cps, 115 or 230 volts a-c. The fan motor is highly inductive and if the square wave inverter was turned off during the peak output, the inductive kickback reflected back into the inverter would be sufficient to damage the power transistors if capacitors C101 and C102 were not provided.

CHAPTER SIX

MAINTENANCE

6.1 GENERAL CONSIDERATIONS

6.2 This Chapter outlines the maintenance procedure applicable to the CP-100 Recorder/Reproducer. These procedures are grouped in the following categories:

(a) Preventive Maintenance
(b) Corrective Maintenance
(c) Adjustments

6.3 All inspection, preventive and corrective maintenance procedures are based on the fact that the recorder/reproducer is designed and constructed as a precision instrument. It must be maintained accordingly to assure consistently satisfactory performance under the environmental conditions in which the equipment is designed to operate.

6.4 Optimum performance can be maintained only if a planned inspection and maintenance program is established. This program should be scheduled based upon the facilities available, the frequency of equipment operation, and the environmental conditions in which the equipment is operated. A suggested planned maintenance schedule is given in Table 6-1. The procedures outlined are extensive; however, it is recommended that they be followed to maintain new system performance for the designed long-life of the recorder/reproducer, and to avoid deterioration of the characteristics of this type of equipment.

6.5 TOOLS AND TEST EQUIPMENT REQUIREMENTS

6.6 The following test equipment and tools, or their equivalents, are recommended for use in performing a complete maintenance program on the CP-100 Recorder/Reproducer. It should be noted that the accuracy of the recorder/reproducer will only be as good as that of the test equipment used to maintain it.

(1) Spring Scales: 0-2 lb, 0-5 lb.
(2) Short length (3-6 ft. approx.) of clean recording tape: 1 mil mylar base or as used in system operation.
(3) Demagnetizer: Ampex Model 704.
(4) Electronic Counter: Hewlett-Packard 523B.
(5) Audio Oscillator: Hewlett-Packard 400CD.

(6) Oscilloscope: Tektronix 631 (including 8 uuf low capacitance probe).

(7) Volt-ohmmeter: Simpson 262.

(8) Pulse Generator: Tektronix 161.

(9) Full Reel of tape: Ampex 1.0 mil mylar base.

(10) Empty reel: Ampex precision type 10-1/2 x 1 inch or 1/2-inch.

(11) Stethoscope: Herbrand Model M51.

(12) Soldering iron: small pencil bit type.

(13) Parallel Bar Stock: 1/4 x 1/2 x 5 in. long.

(14) Pair of Tweezers.

(15) Lint-free cleaning cloth, cotton swabs.

(16) Head Cleaner: Ampex part No. 087-007.

(17) Stroboscope: General Radio Strobotac Type 631BL.

(18) Set of feeler gauges.

(19) Set of miscellaneous hex wrenches, screwdrivers.

(20) Band Pass Filter: Kron-hite Model 330M.

(21) Digital Voltmeter, Non-Linear Systems Model 481.

6.7 PREVENTIVE MAINTENANCE

6.8 The preventive maintenance program should include inspection, cleaning and demagnetization procedures. It must be borne in mind that the mechanical portions of this equipment are constructed and assembled to precise tolerances. Some of the assemblies, noted as not to be disassembled, are ground in place after assembly. Any disassembly of these parts may lead to serious degradation of performance. The parts list can be used as a guide to any disassembly required.

6.9 The recorder/reproducer has been properly adjusted and inspected at the factory prior to shipment, consequently the adjustments outlined in this chapter should be made only when necessary.

6.10 Table 6-1 (a), (b) and (c) give the recommended maintenance schedule. All or part of the schedule may be used according to the facilities available, and the usage to which the equipment is subjected. It is recommended that each item on this schedule be completed upon removal of the equipment from long-term storage.

Table 6-1(a) Recommended Preventive Maintenance Schedule: Inpsection and Tests

DESCRIPTION	SECTION REFERENCE	PRE-OPERATIONAL	DAILY	WEEKLY	MONTHLY
DRIVE BELTS	6.12			X	
SAFETY SWITCH	6.13	X			
SUPPLY BRAKE	6.14			X	
TAKE-UP BRAKE	6.15			X	
HOLD-DOWN KNOBS	6.16				X
CABLES	6.17			X	
TAPE TENSION	6.18				X
EXCITER LAMPS	6.19	X			
TAPE REMAINING	6.20	X			
PINCH ROLLER GRIP	6.21				X*
BELT TENSION	6.22				X
BELT TRACKING	6.22				X
CAPSTAN SPEED	6.23				X
TAPE TRACKING	6.24	X			
EQUIPMENT VOLTAGES	6.25	X			
ELECTRONICS ALIGNMENT	6.26			X	
FLUTTER	6.28-6.35			X	

* Semi-annually

Table 6-1(b) Recommended Preventive Maintenance Schedule: Demagnetization

DESCRIPTION	SECTION REFERENCE	PRE-OPERATIONAL	DAILY	WEEKLY	MONTHLY
HEADS	6.36	X			
CAPSTAN	6.36	X			
TAPE GUIDES	6.40	X			

Table 6-1(c) Recommended Preventive Maintenance Schedule: Cleaning and Lubrication

DESCRIPTION	SECTION REFERENCE	PRE-OPERATIONAL	DAILY	WEEKLY	MONTHLY
TAPE TRANSPORT	6.42				X
HEAD ASSEMBLIES	6.43	X			
TAPE GUIDES	6.43	X			
CAPSTAN	6.43	X			
PINCH ROLLER ASSEMBLIES	6.43	X			
PHOTOCELL ASSEMBLY	6.44				X*
PULLEY SURFACES	6.45			X	
DRIVE BELTS	6.46			X	
BELT TENSION PULLEY SLIDE	6.47				X
BRAKE ASSEMBLIES, SUPPLY AND TAKE-UP	6.48				X*
BEARINGS	6.49				X*
PRINTED CIRCUIT BOARDS	6.50				X*
AIR FILTERS	6.51				X

*Semi-annually

WARNING

UNLESS OTHERWISE SPECIFIED, ALL POWER MUST BE REMOVED FROM THE TRANSPORT WHILE TESTS AND ADJUSTMENTS ARE PERFORMED.

6.11 INSPECTION AND TESTS

6.12 DRIVE BELTS

Step 1: Remove the tensioning load on the drive belts by sliding the intermediate pulley towards a point midway between the capstan and the drive motor. Remove the drive belts.

Step 2: Examine the belts for wear and deformation and replace if necessary.

6.13 SAFETY SWITCH

Step 1: Rotate the safety switch actuating arm on the take-up tape guide. The actuation of the switch should be audible as the arm is rotated, and the switch should operate just before the arm reaches the end of its counterclockwise travel.

6.14 SUPPLY BRAKE

Step 1: Push the tension arm tape guide toward the capstan drive motor cover and spin the turntable. The turntable should rotate freely.

Step 2: With the turntable rotating freely, the tension arm guide should be allowed to return to its static position. The turntable should then decelerate free of eccentric drag. Repeat several times to prove proper brake action.

Step 3: With the supply brake in its static position, attempt rotation of the turntable in both directions, observing a higher drag in the counterclockwise direction than in the clockwise direction. Minimum drag should be 12-16 oz., and maximum drag should be 2-1/2 to 3-1/2 lb.

6.15 TAKE-UP BRAKE

Step 1: Push the tension arm tape guide toward the capstan drive motor cover and spin the turntable. The turntable should rotate freely.

Step 2: With the turntable rotating freely, the tension arm guide should be allowed to return to its static position. The turntable should then decelerate free of eccentric drag. Repeat several times to prove proper brake action.

Step 3: With the Take-up brake in its static position, attempt rotation of the turntable in both directions, observing a higher drag in the counterclockwise direction than in the clockwise direction in a ratio of 3+:1. Minimum drag should be 12-16 oz.

6.16 HOLD-DOWN KNOBS

Step 1: Rotate the hold-down knob cam assemblies observing smooth rotation and free operation of the reel hub dogs.

6.17 CABLES

Step 1: Inspect cables for damaged insulation, loose cable clamps, bent or broken connector pins, or cable conductors.

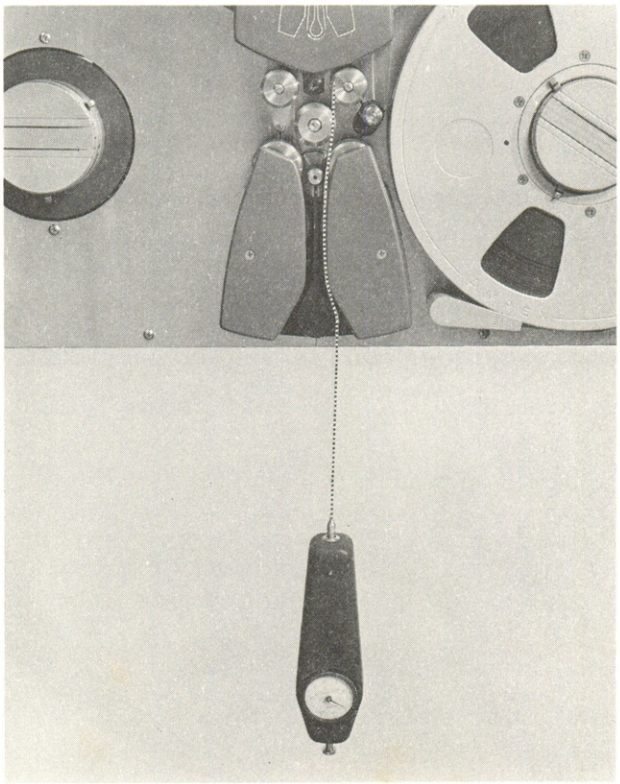


Figure 6-1 Tape Tension Measurement

6.18 TAPE TENSION

Step 1: Load the supply turntable with a full reel of tape.

Step 2: Thread the tape as shown in Figure 6-1.

Step 3: Wrap the end of the tape with pressure-sensitive tape and attach the spring balance.

Step 4: Check that the force applied, through the spring balance, to pull tape from the supply reel is 8 to 11 ounces.

6.19 EXCITER LAMPS

Step 1: Apply power to the transport (see Section 3.12).

Step 2: Check that the light from the exciter lamps is visible between the bottom of the frame of the turnaround idler assembly and the idler barrel.

Step 3: If no further tests, involving power being applied to the equipment, are to be carried out, remove power from the transport.

6.20 TAPE REMAINING (If Remote Control Unit is Used)

Step 1: With power applied to the transport, load a full reel of tape onto the supply turntable and release the tape follower arm from the park position, so that the tip of the arm rests against the full tape pack.

Step 2: Observe that the tape remaining indicator on the Remote Control Unit shows a F(ull) reading.

Step 3: Place the tape follower arm in the park position and remove the full reel of tape.

Step 4: Load an empty reel onto the supply turntable and release the tape follower arm from the park position, so that the tip of the arm rests against the outside diameter of the reel.

Step 5: Observe that the tape remaining indicator on the Remote Control Unit shows an E(mpty) reading.

Step 6: Move the indicator arm through its travel and check that the tape remaining indicator on the Remote Control Unit moves from Empty to Full according to the position of the follower arm. Table 6-2 may be used as a guide to the playing time remaining for a given meter reading.

Table 6-2 Playing Time (minutes) vs. Tape Remaining Indication

Tape Remaining	Playing Time in Minutes*					
	1-7/8 ips	3-3/4 ips	7-1/2 ips	15 ips	30 ips	60 ips
1/8	32;48	16;24	8;12	4;6	2;3	1;1-1/2
1/4	64;96	32;48	16;24	8;12	4;6	2;3
3/8	96;144	48;72	24;36	12;18	6;9	3;4-1/2
1/2	128;192	64;96	32;48	16;24	8;12	4;6
5/8	160;240	80;120	40;60	20;30	10;15	5;7-1/2
3/4	192;288	96;144	48;72	24;36	12;18	6;9
7/8	224;336	112;168	56;84	28;42	14;21	7;10-1/2
full	256;384	128;192	64;96	32;48	16;24	8;12

* For 2400-ft. and 3600-ft. reels respectively

Step 7: If no further tests, involving power being applied to the equipment, are to be carried out, remove power from the transport.

6.21 PINCH ROLLER GRIP

Step 1: Simulate the closure of the safety switch by wrapping a rubber band between the guide on the arm and the screw on the motor cover as shown in Figure 6-2.

Step 2: Wrap one end of a short length of tape (2-3 feet) with pressure-sensitive tape and thread the tape as shown in Figure 6-2, i. e., round the supply tension arm guide, round the supply tape guide, between the (right-hand) pinch roller and the capstan, and past the record heads. The oxide side of the tape must face the heads.

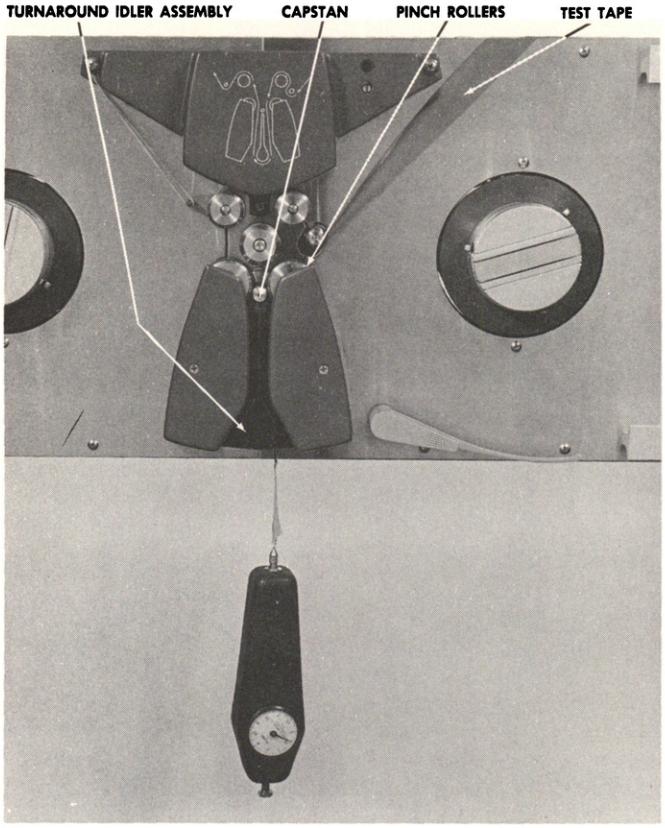
Step 3: Check that the take-up reel turntable is free from obstruction and is free to rotate. Check that the tape follower arm is in the park position. Attach the spring balance to the test length of tape as shown in Figure 6-2.

Step 4: Remove the drive belts from the underside of the transport.

Step 5: Apply power to the transport. Depress the DRIVE pushbutton.

Step 6: Manually spin the turnaround idler barrel rapidly to cause the pinch roller to clamp the test length of tape to the capstan. Check that both pinch rollers close.

Step 7: Check that the tape starts to slip at a pull of 22 to 28 ounces as indicated on the spring balance.



8298-10

Figure 6-2 Pinch Roller Measurement

Step 8: Remove the test tape from the right-hand pinch roller and capstan.

Step 9: Thread the tape between the (left-hand) pinch roller and capstan, past the monitor heads.

Step 10: Repeat Steps 1, 3, 5 and 6 above.

Step 11: Check that the tape starts to slip at a pull of 22 to 28 ounces as indicated on the spring balance. The supply pinch roller tension as measured in Step 8 above should be equal to or greater than the take-up pinch roller tension.

Step 12: Depress the STOP pushbutton. Remove power from the transport.

Step 13: Remove the rubber band and other test equipment.

Step 14: Replace the drive belts following the procedure in Section 3.7 Step 2 as required.

6.22 BELT TENSION AND TRACKING

Step 1: Any time the belts have been removed for either a desired change of speed range or the performance of a test procedure, check that the intermediate pulley is providing sufficient tension to prevent belt slippage. The intermediate pulley is spring-loaded to provide the necessary belt tension when returned to its normal position.

Step 2: Apply power to the transport.

Step 3: Observe that there is little or no side travel in the belt motion and that the belts do not contact the flanges on the pulleys or capstan flywheel.

Step 4: If no further tests are to be performed, remove power from the transport.

6.23 CAPSTAN SPEED

Step 1: With the belts installed for a desired speed range, apply power to the transport.

Step 2: Use a stroboscope (properly calibrated with an EPUT meter or similar counter) and check that the rotation of the capstan, corresponding to the speed range selected, conforms with the readings given in Table 6-3 below.

Table 6-3 Tape Speed vs. Capstan Rotation

TAPE SPEED (ips)	CAPSTAN ROTATION (rpm)	
	Maximum	Minimum
60	2423	2391
30	1212	1196
15	606	598
7-1/2	303	299
3-3/4	152	150
1-7/8	76	75

Step 3: If no further tests are to be performed, remove power from the transport and remove the test equipment.

6.24 TAPE TRACKING

Step 1: Load a full reel of tape onto the supply turntable and complete the tape threading path (see Section 3.6). With the drive belts in place, select a tape speed.

Step 2: Apply power to the transport.

Step 3: Depress the DRIVE pushbutton.

Step 4: Observe that tape motion commences and that the pinch rollers are actuated. During the motion of the tape, there must be no signs of curling of the tape edges caused by the tape being in contact with the flanges of any of the tape guides. The tape may lightly scrape the reel flanges, but no visible curl of the tape is allowable.

Step 5: At the completion of this test, place the transport in the FAST FORWARD or REWIND mode. Either allow the safety switch to automatically stop the transport or depress the STOP pushbutton when all tape is returned to one of the reels. Remove power from the transport if no further tests are to be performed.

6.25 EQUIPMENT VOLTAGES. Before placing the equipment in operation for a data-gathering run or performing the alignment procedures for the system electronics, the following voltages should be checked and verified at the Test Panel.

(a) 28 volts d-c
(b) +12 volts d-c
(c) -12 volts d-c
(d) 115 volts a-c

Step 1: Apply power to the equipment.

Step 2: Using a suitable voltmeter connected between the 28V jack and GND jack, observe that the voltage reading is 26-30 volts d-c (28 volts, ±2 volts).

Step 3: Connect a digital voltmeter across the +12V and GND jacks and observe that the voltage reading is +12 volts ±0.2% (+11.976 to +12.024 volts).

Step 4: Connect the digital voltmeter across the -12V and GND jacks and observe that the voltage reading is -12 volts ±0.2% (-11.976 to -12.024 volts).

Step 5: Connect the a-c voltmeter across the white CAPSTAN 60 CPS jacks and observe that the voltage reading is 115 volts ±5% (110 to 120 volts a-c), with the capstan at speed.

Step 6: If no further tests are to be performed, remove power from the system and remove test equipment.

6.26 ELECTRONICS ALIGNMENT

6.27 The alignment of the system electronics being used is recommended as a weekly test of performance. Details of specific procedures are outlined in Chapter Four, Check-out and Alignment, of this manual. In carrying out any or all of these procedures the following conditions should be established beforehand.

(a) The equipment is properly installed as outlined in Chapter 2.

(b) The drive belts are properly in place for the desired speed range.

(c) Sections 6.12 through 6.25, as applicable, when carried out indicate satisfactory performance.

(d) The components of the system have been properly cleaned and lubricated as required.

(e) The head assemblies have been correctly demagnetized as outlined in Section 6.36.

(f) Unused or properly bulk-erased recording tape is to be used.

(g) If a large 60-cps signal appears on the reproduce test jack output, but not on the BNC output connector, a ground loop is being forced into the system by grounding the black GND test jack. This is usually the result of using power-grounded instrumentation and simultaneously grounding the power and electronics grounds together in an undesired manner. The ground loop may be eliminated by disconnecting the ground test lead at the reproduce amplifier test point. No ground loops will occur at the data input and output BNC connectors regardless of the grounded instrumentation.

6.28 FLUTTER

6.29 There are three general categories of causes of flutter or non-uniform tape motion which may be found in the CP-100 Recorder/Reproducer. Flutter frequencies below 100 cps may be attributed generally, though not always, to rotating parts such as idlers,

flywheels, shafts, and the capstan. Low frequency flutter of the order of 70 cps may be caused by a mechanical resonance due to the mass of the capstan flywheel and the compliance of the capstan motor and drive motor spring pulley. This is ordinarily not a problem, unless it is excited by some mechanical or electrical disturbance. In cases where this oscillation will not damp out, but continues to ring, the capstan motor is probably defective.

6.30 A second source of flutter is that produced by mechanical vibration which causes either the heads or tape or both to vibrate. This is apt to appear as flutter frequencies from 60 to several hundred cps. These vibrations may be caused by any one or a number of components: the torque motors or the capstan motor. Vibrations are usually transmitted through the transport frame and may be induced into some susceptible component which then vibrates at the same or some multiple of the disturbing frequency.

6.31 The third source of flutter accounts for the higher frequency flutter components which are not generally discernible as a single frequency. In its simplest form, this may be considered to consist primarily of the vibration of the unsupported length of tape under tension within the closed loop. (This is analogous to the vibrations of a stretched rubber band).

6.32 The frequencies and amplitude will be determined primarily by the geometry and size of the unsupported length of tape. Some high frequency flutter components are also generated by the minute surface irregularities of the tape itself as it passes over the heads. Generally, this type of flutter is minimized by keeping the unsupported length of tape as short as possible. Other than keeping the head surfaces clean and ensuring that high quality tape in good condition is used, there is not much that can be done to change the high frequency flutter characteristics of the machine.

6.33 Flutter is generally measured by recording an undeviated FM center carrier signal onto the tape which is then reproduced into some type of calibrated FM discriminator or FM reproduce amplifier. Frequency deviation is then converted to a known voltage which may be displayed on an oscilloscope, read on a meter, or in some way measured to indicate the percentage flutter.

6.34 FLUTTER MEASUREMENT

6.35 The following procedure may be carried out to measure flutter using standard CP-100 recording and reproducing components. The equipment required is as follows:

(a) Full reel of degaussed tape

(b) Audio Oscillator, Hewlett-Packard 400 CD or equivalent

(c) CP-100 FM Record and Reproduce Amplifier Modules

(d) Band pass filter, Kron-hite Model 330M or equivalent

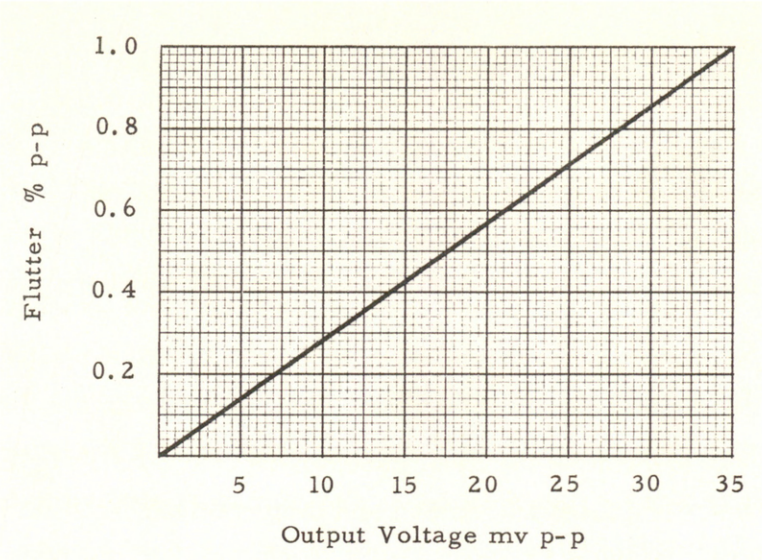
(e) Oscilloscope, Tektronix 631 or equivalent

Step 1: Calibrate an FM record/reproduce system, following the procedures outlined in Section 4.34 through 4.47 as applicable, at a tape speed of 60 ips. Flutter is measured by examining the output voltage excursions from the FM reproduce amplifier on the oscilloscope monitoring an undeviated FM center carrier. These voltage changes will be proportional to the frequency deviation from the reproduce amplifier corresponding to changes in instantaneous tape speeds. An output voltage change of 1.414 volts from a properly calibrated reproduce amplifier is equivalent to a frequency deviation of 40%, or a peak-to-peak frequency swing of 80% produces an output voltage of 2.828 volts peak-to-peak. Consequently, 2.828 volts peak-to-peak indicates 80% peak-to-peak flutter. A 10% peak-to-peak flutter indication would correspond to 2.828/8 volts, which is equal to 0.35 volt peak-to-peak, or 0.125 volt rms.

Step 2: Set the transport for a tape speed of 60 ips. Set the oscillator frequency to 100 cps and a voltage of 0.125 volt rms to drive the FM record amplifier. While recording this signal, monitor the outputs of the reproduce amplifier on the oscilloscope and calibrate the oscilloscope for four divisions peak-to-peak. If band-limited readings are to be made, connect the reproduce output to a band pass filter. With the oscilloscope calibrated to read 10% flutter, a decade divider on the vertical attenuator would then calibrate the oscilloscope to read 2% flutter. A visual oscilloscope reading is approximately equivalent to the flutter components remaining within the specified limits 95% of the time.

Step 3: With the FM record and reproducer system calibrated, and the oscilloscope calibrated to indicate 2% flutter in four divisions, short the data input to the FM record amplifier.

Step 4: Place the system in the RECORD mode and the FM record amplifier is then recording an undeviated center carrier. The output from the FM reproduce amplifier shown in the oscilloscope will be proportional to the center carrier frequency deviations which correspond to instantaneous speed variations and



50986

Figure 6-3 Percentage Peak-to-Peak Flutter vs. Output Voltage

thus represent the peak-to-peak flutter. It should be recognized that some portion of the signal represents noise and distortion in the electronics and cannot be isolated from the signal due to flutter components. The graph shown in Figure 6-3 shows the percentage peak-to-peak flutter as a function of the output voltage over a typical range of values.

Step 5: Repeat measurement at other bandwidths and tape speeds as desired. FM center carrier frequencies to be recorded at the other speeds are 30 ips, 54 kc; 15 ips, 27 kc; 7-1/2 ips, 13.5 kc; 3-3/4 ips, 6.75 kc; 1-7/8 ips; 3.375 kc.

Step 6: Remove power from the transport.

6.36 DEMAGNETIZATION

6.37 HEAD ASSEMBLIES. The heads are most readily demagnetized using an Ampex Model 704 Demagnetizer. The procedure can be carried out with the heads mounted on the tape transport.

CAUTION

IF THE TIPS OF THE DEMAGNETIZER ARE NOT COVERED WITH A MATERIAL TO PROTECT THE HEADS, COVER THESE TIPS WITH A LENGTH OF VINYL ELECTRICAL TAPE.

Step 1: Connect the demagnetizer to a source of 117 volts, 60 cps, a-c power.

Step 2: Bring the tips of the demagnetizer close to the head stack which is to be demagnetized. Straddling the head gaps with the tips of the demagnetizer, slowly draw the demagnetizer three or four times along the entire length of the head stack, and at the same time remove the demagnetizer from the head very slowly, allowing the influence of the a-c field to die gradually.

Step 3: Repeat Step 2 for all other head stacks.

6.38 If it is convenient to remove the head assemblies from the Tape Transport, the following procedure can be carried out to remove and demagnetize the head assemblies.

Step 1: Unscrew the single cross-recessed screw securing each head cover in place. Remove the head covers.

Step 2: Disconnect the four head connector plugs.

Step 3: Using the hex wrench provided under one of the head covers, unscrew the three socket head cap screws securing each head assembly in place. Lift the head assemblies carefully from the transport casting making sure that the heads are not scratched or come in contact with any part of the transport.

CAUTION

DO NOT USE CARBON TETRACHLORIDE OR SIMILAR SOLVENTS IN THE NEXT STEP FOR CLEANING PURPOSES. THESE AGENTS MAY DISSOLVE THE HEAD LAMINATION ADHESIVE. USE ONLY RECOMMENDED CLEANER.

Step 4: Clean the head assemblies using a lint-free cloth or cotton swabs moistened with head cleaner (Ampex part no. 087-007). Carefully wipe all parts dry so that all oxide, lubricant and dirt are removed.

CAUTION

IF THE TIPS OF THE DEMAGNETIZER TO BE USED ARE NOT COVERED WITH A MATERIAL TO PROTECT THE HEADS, COVER THESE TIPS WITH A LENGTH OF VINYL ELECTRICAL TAPE.

Step 5: Connect the demagnetizer (Ampex Model 704) to a source of 117 volts, 60 cps, a-c power.

Step 6: Bring the tips of the demagnetizer close to the head stack to be demagnetized. Straddling the head gaps with the tips of the demagnetizer, slowly draw the demagnetizer three or four times along the entire length of the head stack and at the same time remove the demagnetizer from the head very slowly, allowing the influence of the a-c field to die gradually.

Step 7: Repeat Step 6 for all other head stacks.

Step 8: Using a lint-free cloth or cotton swabs thoroughly clean the head mounting area before reinstalling the head assemblies.

Step 9: Before returning the head assemblies to the transport casting, demagnetize the capstan, using the Model 704 demagnetizer. Run the demagnetizer tips slowly up and down the entire length of the capstan while slowly rotating the latter manually.

Step 10: Remove the demagnetizer and disconnect from its power source.

Step 11: Replace the head assemblies onto the transport casting using the three socket head cap screws to secure each head assembly in place. Return the hex wrench to its storage place in the head cover. Reconnect the head connector plugs. Replace the head covers securing each in place with the single cross-recessed drive screw provided.

6.39 It should be noted that any action tending to drive a large direct current through the head will magnetize them. If the following precautions are observed, no difficulty should be encountered. DO NOT:

(a) Connect or disconnect signal input or record head connectors while the system is in the RECORD mode.

(b) Test continuity of the heads with an ohmmeter or similar tester without properly demagnetizing the head assemblies immediately afterwards.

(c) Allow magnetized objects to touch any part of the transport.

6.40 DEMAGNETIZATION OF TAPE GUIDES

Step 1: Connect the demagnetizer (Model 704) to a source of 117 volts, 60 cps, a-c power.

Step 2: Move the tips of the demagnetizer slowly up and down the entire length of each of the tape guides, in turn, while slowly rotating the guides manually and at the same time remove the demagnetizer slowly, allowing the influence of the a-c field to die gradually.

Step 3: Remove and disconnect the demagnetizer from its power source.

6.41 CLEANING AND LUBRICATION

6.42 TAPE TRANSPORT. The Tape Transport must be cleaned periodically to prevent the build-up of dirt which would degrade system performance. It is recommended that the same liquid cleaner used for the heads, capstan and tape guides, also be used for other parts of the transport. A vacuum cleaner may be used to reach inaccessible areas. DO NOT USE THE CLEANER AS A BLOWER. This may cause dust to be blown into bearings and other critical areas. Tape oxide or lubrication accumulation on the heads will prevent proper head-to-tape contact causing loss of information or drop-out. Oxide or lubrication accumulation on the tape guides will cause excessive wear of the tape. Oxide or lubricant accumulation on the capstan or pinch rollers will cause loss of positive drive to the tape and will adversely affect recording of data. After cleaning the transport, dry all surfaces thoroughly using a lint-free cloth.

6.43 HEADS, TAPE GUIDES, CAPSTAN AND PINCH ROLLERS. Cleaning of the head assemblies, tape guides, capstan and the pinch rollers can be readily accomplished at the time when the heads may have been removed for demagnetization. The procedure is outlined in Section 6.37, Steps 4 and 8. However, if these components are to be cleaned in place, the same procedure can be followed, using dry cotton swabs to remove excess cleaner in limited-access areas.

6.44 PHOTOCELL ASSEMBLY

Step 1: Remove the head covers by unscrewing the single cross-recessed drive screw securing each in place.

Step 2: Disconnect the head connector plugs. Using the hex wrench provided under one of the head covers, unscrew the three socket head cap screws securing each head assembly in place. Remove the head assemblies and wrap in a soft, lint-free material.

Step 3: Unscrew the two socket head cap screws securing the turnaround idler assembly to the transport casting. The idler assembly can be raised sufficiently far to permit the three cross-recessed retaining screws securing the photocell assembly to be removed.

Step 4: Remove the three retaining screws. Remove the two lamps from the idler housing.

Step 5: Clean the two lamps, the photocell on its mounting plate and the photocell lens using the recommended cleaning agent.

Step 6: Re-assemble the photocell assembly onto the turnaround idler making sure that with the two lamps in place there is no drag on the turnaround idler barrel. Lamp envelopes may not be symmetrical and may touch the inside of the barrel as the latter rotates. This condition can be corrected by rotating the lamps in their respective sockets.

Step 7: Replace the turnaround idler assembly, the head assemblies, and the head covers.

6.45 PULLEY SURFACES

Step 1: Remove the tensioning load on the drive belts by sliding the intermediate pulley towards a point midway between the capstan and the drive motor. Remove the drive belts.

Step 2: Clean pulley surfaces using the recommended cleaning agent. Dry thoroughly with a lint-free cloth.

Step 3: Replace the belts. Follow procedure in Section 6.22 to check belt tension and tracking.

6.46 DRIVE BELTS

Step 1: The belts may be cleaned, while in position on the pulleys, by scrubbing lightly with a cloth or cotton swab barely moistened with cleaning agent. Do not soak the belts during this operation.

6.47 BELT TENSION PULLEY SLIDE

Step 1: Remove the belts and the capstan.

Step 2: Remove the intermediate pulley assembly and disassemble.

Step 3: Clean the sliding surface of the motor mount with the recommended cleaning agent and dry thoroughly using a clean lint-free cloth.

Step 4: After wiping the teflon washers clean with a dry lint-free cloth, apply a thin coating of silicon grease.

Step 5: Re-assemble intermediate pulley assembly. Replace capstan and belts. Follow procedure in Section 6.22 to check belt tension and tracking.

6.48 TAKE-UP AND SUPPLY BRAKE ASSEMBLIES

Step 1: Remove the overlay plate to gain access to both brake assemblies.

Step 2: Using fine sandpaper between the brake drum and band, holding the brake partially released, rotate the brake drum and sandpaper several times over the brake band surface.

Step 3: With the sandpaper removed and holding the brake fully released, clean the brake drum using clean, dry, lint-free cloth.

Step 4: Wipe the brake band using a clean, dry cloth.

Step 5: Remove all dust particles.

Step 6: Check brake settings and re-adjust if necessary. See Sections 6.14, 6.120 and 6.121.

6.49 BEARINGS. All rotating bearing surfaces in the Tape Transport are life-lubricated and no lubrication should be attempted. If the ball bearings become dry, noisy or rough, unless special instrument bearing cleaning facilities are available, such bearings must be replaced. For the capstan, drive motor pulley, turnaround idler, and drive and torque motor bearings, since disassembly of these parts is not recommended, the complete assemblies must be replaced.

6.50 PRINTED CIRCUIT BOARDS

Step 1: Clean the rhodium-plated contacts of the printed circuit card connector only by "scrubbing" with a clean lint-free cloth. Clean dirt from the card by brushing with a soft brush.

6.51 CLEANING AIR FILTERS. Three air filters are provided, one on each side and one on the end of the case. Inspect the filters periodically for an accumulation of dust. Clean the filters as follows:

Step 1: Remove each filter from the outside of the case after removing the two cross-recessed drive attaching screws.

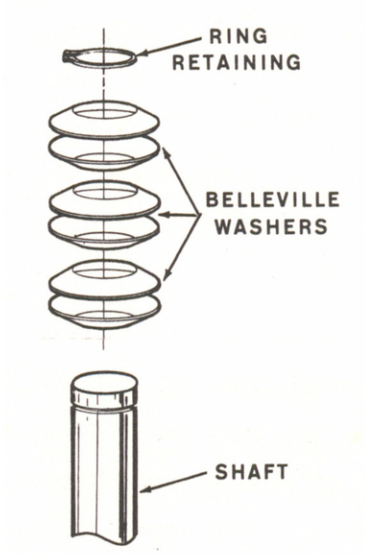
Step 2: Wash the filters with a solution of water and detergent.

Step 3: Allow the filters to dry thoroughly before replacing.

6.52 CORRECTIVE MAINTENANCE

6.53 This portion of the Maintenance Chapter indicates the necessary procedures required when the CP-100 Recorder/Reproducer fails to respond to proper alignment, to check out satisfactorily, or to operate within specifications. The procedures which follow are based upon systematic adjustment or, when required, removal and replacement of a part to correct an observed fault.

6.54 In those cases, where adjustment alone is necessary, certain disassembly procedures may be required to gain access to the malfunctioning part. Where replacement of the part is required, the faulty part should be removed by proper disassembly, re-assembled correctly and adjusted as required. Care is to be exercised at all times in the actual removal of parts and their subsequent replacement. Figure 6-4 shows the proper manner in which Belleville washers should be re-assembled.



50987

Figure 6-4 Belleville Washers Assembly

6.55 The Parts List in the manual can be consulted as a guide to parts identification and location during any phase of maintenance of the CP-100 Recorder/Reproducer components.

6.56 In cases where electronics parts are to be removed from printed circuit boards, DO NOT DAMAGE THE PRINTED CIRCUIT BOARDS BY APPLYING TOO MUCH HEAT FROM THE SOLDERING IRON.

6.57 It is recommended that a clean, flat, padded surface be used as a working area during disassembly. It will be helpful during re-assembly, if the disassembled parts are laid out in the order of removal.

6.58 PROGRESSIVE DISASSEMBLY OF THE TAPE TRANSPORT

6.59 The procedures of the following sections is to be carried out ONLY to the point where a specific inspection, cleaning, or some preventive or corrective maintenance is to be done. Figure 6-21, the Progressive Disassembly Chart, shows the sequence of procedure which is to be carried out in disassembling the Tape Transport to any desired degree.

6.60 The complete disassembly is divided into three main groups, allowing immediate access to specific parts without any further unnecessary disassembly. These groups are:

(a) Initial Disassembly (does not require removal of overlay-plate)
(b) Intermediate Disassembly (requires removal of overlay-plate)
(c) Final Disassembly (requires removal of capstan assembly).

6.61 To use the Disassembly Chart effectively, locate the name of the part to be removed on the chart. If marked in BLACK, this indicates the minimum amount of disassembly required to remove the part or assembly from the Tape Transport. Names of parts duplicated in RED, indicate intermediate steps for the removal of other parts, and are not the most direct point at which that part may be removed. After each name a section reference for the specific disassembly procedure is given.

6.62 Once the name of the part to be removed is located on the chart, follow the disassembly procedures referenced, starting at the top of the chart and using the most direct approach to the desired part. Figures 6-22, 6-23, and 6-24 shows the location of parts on the Tape Transport. The Progressive Disassembly Chart, Figure 6-21 can be used also as a guide in re-assembly of the Tape Transport, the order and procedure for re-assembly being the reverse of those for disassembly. When specifically noted, certain adjustment

procedures may be required before final tightening of screws, nuts, etc.

WARNING

UNLESS OTHERWISE SPECIFIED, ALL POWER MUST BE REMOVED FROM THE TRANSPORT DURING DISASSEMBLY.

6.63 INITIAL DISASSEMBLY

6.64 TAPE TRANSPORT REMOVAL FROM FRAME ASSEMBLY

NOTE

The Tape Transport can be removed from frame assembly for convenience ONLY, and is not a pre-requisite for disassembly of the transport.

Step 1: With the transport in the horizontal position, loosen the setscrew securing the hinge pin on the lelectronics side of the transport. Raise and hold the transport to the vertical position and remove the cables from the connector bracket. While supporting the transport, remove the hinge pin, pivoting the transport slightly and slide the other hinge pin out of the hinge. The Tape Transport can now be lifted out of the frame assembly.

6.65 HARNESS COVER

Step 1: Remove the four cross-recessed screws securing the cover to the side of the transport casting. Lift off the harness cover.

6.66 TORQUE MOTOR POTENTIOMETER R10

Step 1: Unsolder the wires from the potentiometer.

Step 2: Remove the nut securing the potentiometer to the relay bracket. Remove the potentiometer R10.

NOTE

The potentiometer will require adjustment after re-assembly (see Section 6.124).

6.67 RELAY ASSEMBLY: K6, K7, R10

Step 1: Identify the wire connections BEFORE unsoldering any leads from the assembly.

Step 2: Remove the two cross-recessed screws securing the assembly to the side of the transport casting and the single cross-recessed screw securing the assembly to the underside of the transport casting. Lift off the relay assembly.

6.68 DELAY RELAY ASSEMBLY: K10, CR3, CR6

Step 1: Unsolder the black wire leading from the assembly to the torque motor r-f filter FL1, at the LINE terminal. Identify the other wire leads BEFORE unsoldering the connections from the assembly.

Step 2: Remove the three cross-recessed screws and nuts securing the filter to the side of the transport casting. Lift out the relay assembly.

6.69 INTERMEDIATE PULLEY BEARINGS

Step 1: Remove the retaining ring securing the pulley to its shaft (see Figure 6-11).

Step 2: Remove the six Belleville washers and pulley from the shaft. (See Figure 6-4 for the method of re-assembly of Belleville washers.)

Step 3: REMOVE THE BEARINGS ONLY IF THEY ARE CONSIDERED FAULTY, AS DAMAGE TO THE BEARINGS MAY OTHERWISE OCCUR, using a suitable flanged bearing extractor tool.

6.70 DRIVE MOTOR PULLEY

Step 1: Loosen the two socket head setscrews securing the drive motor pulley to the motor shaft and remove the pulley from the shaft.

CAUTION

DURING RE-ASSEMBLY, MAKE SURE THAT THE SET-SCREWS SEAT AGAINST THE FLATS ON THE SHAFT AND NOT THE SHAFT.

6.71 DRIVE MOTOR PULLEY SPRING

Step 1: Note the orientation of the spring for future re-assembly, i.e., the spring winds up when power is applied to the drive motor (see Figure 6-10).

Step 2: Remove the two #0-80 round-head screws securing the retaining wire over the end of the spring.

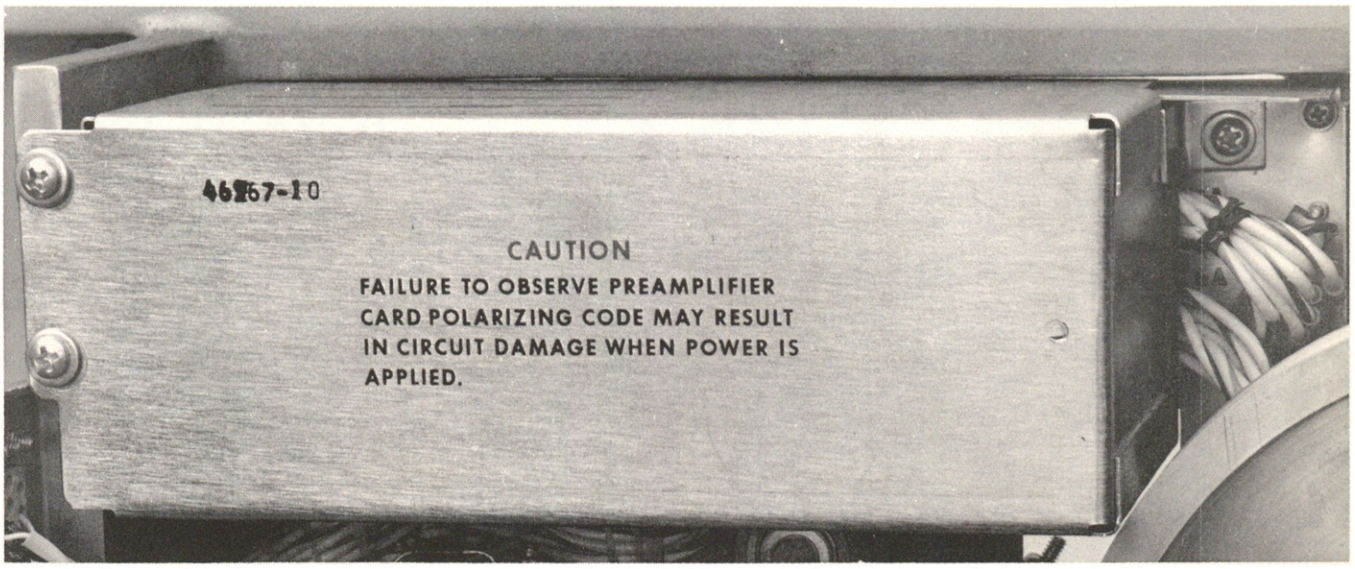
Step 3: Using a pair of tweezers, lift off the retaining wire and pulley spring.

CAUTION

DO NOT DISASSEMBLE THE DRIVE MOTOR PULLEY BEYOND THIS POINT.

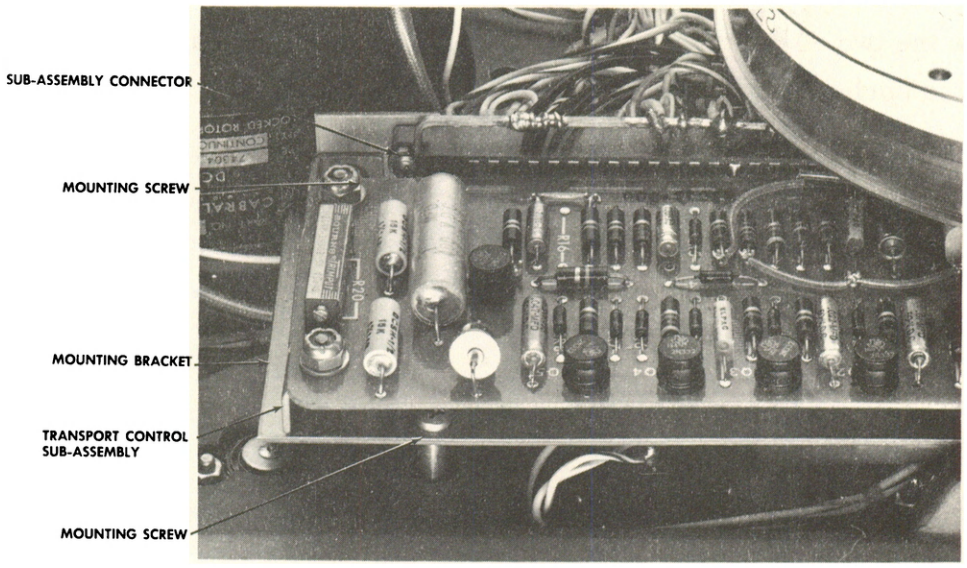
6.72 PRE-AMPLIFIER COVER

Step 1: Loosen the three cross-recessed screws, securing the cover to the chassis. Lift off the cover.



8298-8

Figure 6-5 Pre-amplifier Cover



8143-15

Figure 6-6 Transport Control Sub-Assembly (Speed Sensing Circuit)

6.73 TAPE TRANSPORT CONTROL SUB-ASSEMBLY (SPEED SENSING CIRCUIT)

Step 1: Unscrew the two cross-recessed screws securing the sub-assembly, by its mounting bracket, to the transport control sub-assembly mounting bracket.

Step 2: Remove the sub-assembly by disconnecting the sub-assembly printed circuit connector from the receptacle connector on the sub-assembly mounting bracket.

6.74 SUPPLY TORQUE MOTOR R-F FILTER: FL1

Step 1: Disconnect the two leads from the filter at the torque motor, and unsolder the black wire at the LINE terminal.

Step 2: Unscrew the two cross-recessed screws securing the filter to the side of the transport casting.

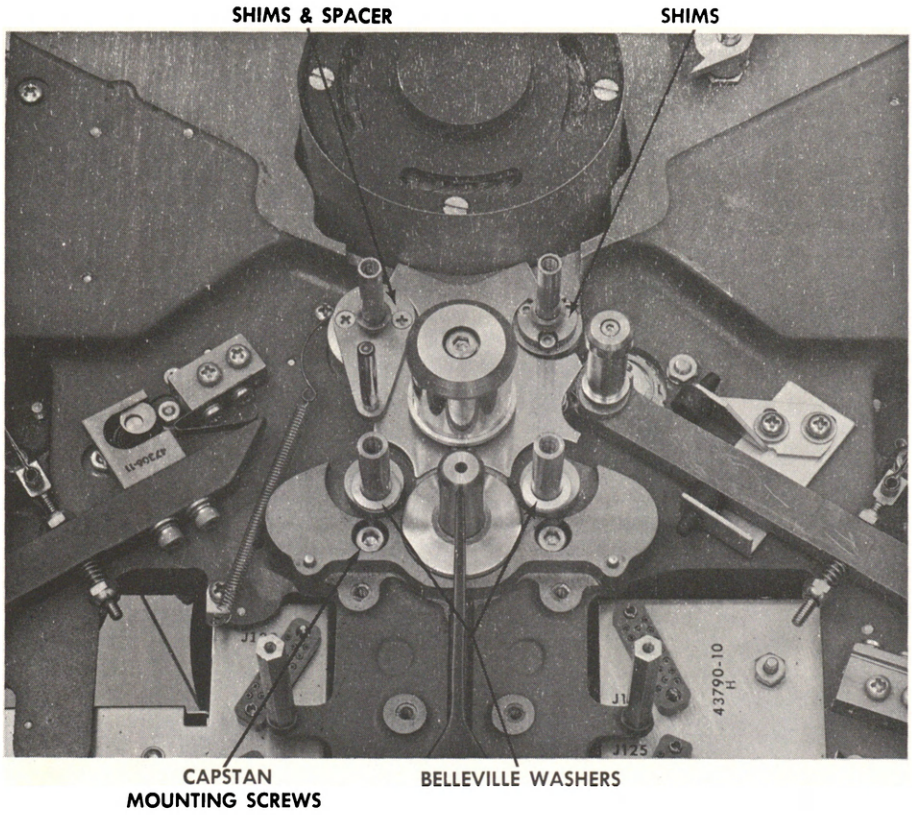


Figure 6-7 Location of Shims and Wavy Washers

6.75 HEAD TAPE GUIDES

Step 1: Remove the supply guide by unscrewing the single slotted screw holding the guide in place. THE SUPPLY GUIDE REQUIRES ADJUSTMENT AFTER RE-ASSEMBLY (see Section 6.129).

CAUTION

WHEN LIFTING OFF THE SUPPLY GUIDE, MAKE SURE THAT ANY SHIMS AND THE TWO WAVY WASHERS UNDERNEATH ARE ALSO REMOVED AND KEPT WITH THE COMPLETE SUB-ASSEMBLY. (SEE FIGURE 6-7.)

Step 2: Remove the take-up guide by unscrewing the single slotted screw holding the guide in place. THE TAKE-UP GUIDE REQUIRES ADJUSTMENT AFTER RE-ASSEMBLY. (See Section 6.129.)

CAUTION

WHEN LIFTING OFF THE TAKE-UP GUIDE MAKE SURE THAT ANY SHIMS AND THE TWO WAVY WASHERS UNDERNEATH ARE ALSO REMOVED AND KEPT WITH THE COMPLETE SUB-ASSEMBLY (SEE FIGURE 6-7).

6.76 TAPE GUIDE BEARINGS

CAUTION

UNNECESSARY REMOVAL OF THESE BEARINGS MAY RESULT IN DAMAGE TO THE BEARINGS.

Step 1: Remove the top bearing using a suitable bearing extractor tool.

Step 2: Remove the retaining ring from the bottom of the tape guide and use a suitable bearing extractor tool to remove the bottom bearing.

6.77 ACTUATOR ARM ASSEMBLY

Step 1: Remove the switch actuator arm assembly by unscrewing the two flat-head screws securing the actuator arm in place.

CAUTION

DO NOT DISASSEMBLE THE ACTUATOR ARM ASSEMBLY BEYOND THIS POINT.

6.78 CAPSTAN MOTOR COVER AND SPEED INDICATOR

Step 1: Unscrew the three cross-recessed screws securing the motor cover to the overlay plate. Lift off the motor cover.

Step 2: Remove the speed indicator by loosening the single socket head setscrew.

6.79 CAPSTAN MOTOR SHIELD

Step 1: Lift out the motor shield from the top of the transport casting. Note the orientation of the cutout during re-assembly. The cutout provides clearance for the capstan drive motor leads.

6.80 TRANSPORT HANDLE ASSEMBLY

Step 1: Unscrew the four socket head cap screws holding the handle blocks to the transport casting. Remove the handle blocks with the overlay plate.

6.81 TAPE REELS

Step 1: If the reels are mounted on the transport, unlock the hold-down knob assemblies. Place the tape follower arm in the park position so that the arm is clear of the supply reel flanges. Lift off the reels from the transport.

6.82 TAPE FOLLOWER ARM

Step 1: Unscrew the single socket head setscrew located at the side of the tape follower arm. Lift off the arm from the fixed shaft of the resistor assembly. THE FOLLOWER ARM REQUIRES ADJUSTMENT AFTER RE-ASSEMBLY. SEE SECTION 6.125.

6.83 REEL HOLD-DOWN KNOBS AND TURNTABLES

Step 1: Raise the handles and rotate the knob assembly one revolution (past detents). Under one handle there is a 3/8 in. diameter hole through the nylon cam. When rotating the knob assembly, note that three flat-head screws pass this hole.

Step 2: Remove the three flat-head screws. Remove the knob assembly, spacer and turntable by pushing the tension arm guide towards the drive motor cover and lifting the knob assembly, spacer, and turntable.

6.84 HEAD ASSEMBLIES

Step 1: Remove the head covers by unscrewing the individual cross-recessed screws securing each cover in place.

Step 2: Disconnect the head stack plug connectors from their respective mating receptacle connectors.

Step 3: Using the hex wrench provided under one of the covers, unscrew the three socket head cap screws securing each head assembly to the transport casting. Remove the head assemblies carefully from the casting.

CAUTION

DO NOT DISASSEMBLE THE HEAD ASSEMBLIES BEYOND THIS POINT. UNMOUNTED HEAD ASSEMBLIES SHOULD BE PROTECTED AGAINST DAMAGE BY BEING WRAPPED IN A SOFT, DRY, LINT-FREE MATERIAL.

6.85 TURNAROUND IDLER

Step 1: Unscrew the two socket head cap screws securing the turnaround idler to the casting. The idler can be raised sufficiently far to permit the three flat-head retaining screws securing the photocell assembly to be removed.

CAUTION

DO NOT DISASSEMBLE THE TURNAROUND IDLER BEYOND THIS POINT, AFTER REMOVAL OF THE EXCITER LAMPS.

6.86 PHOTOCELL ASSEMBLY AND EXCITER LAMPS (DS1A AND DS1B)

Step 1: Unsolder the four leads connected to the terminals of the photocell assembly and remove the assembly from the transport casting.

Step 2: Lift out the two exciter lamps from the turnaround idler.

6.87 PRE-AMPLIFIER CHASSIS

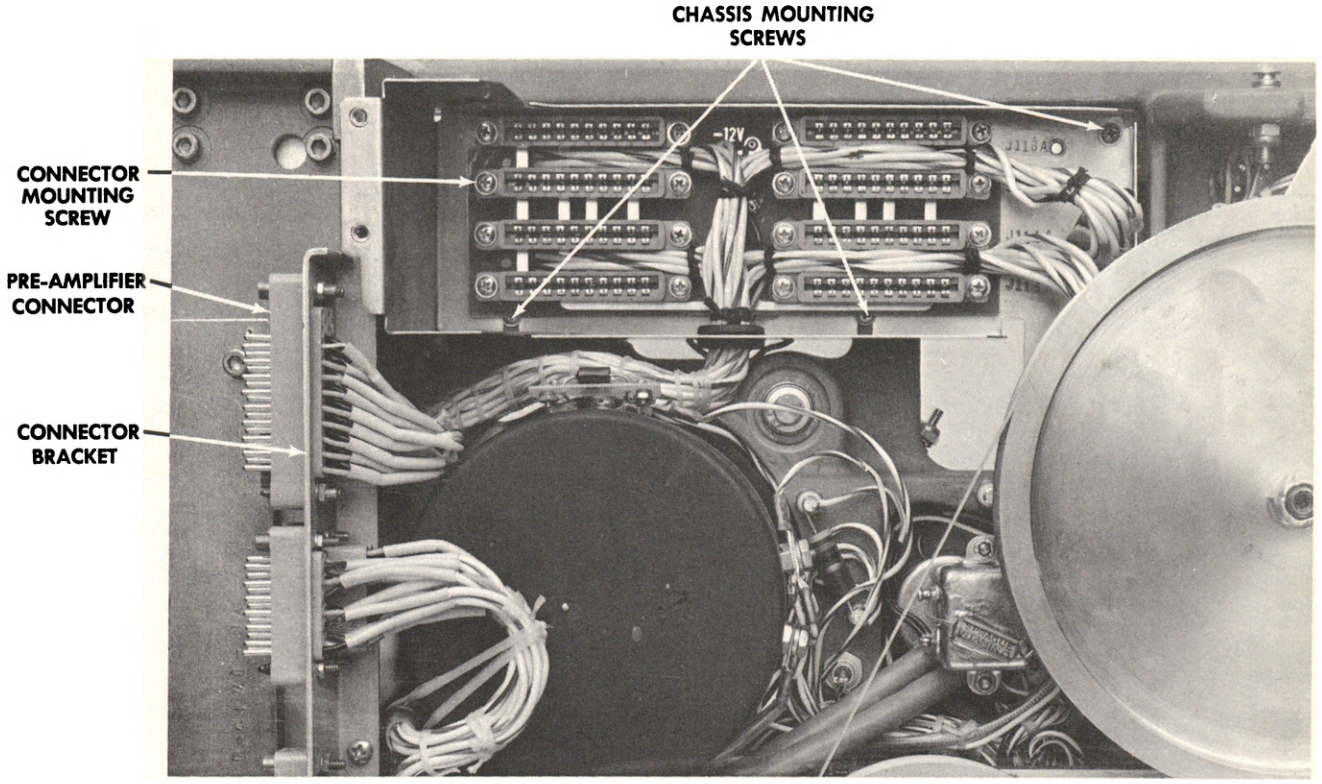
Step 1: Remove the Pre-amplifier cards from the chassis.

Step 2: Remove the four nuts securing the pre-amplifier connector receptacle to the connector bracket.

Step 3: Remove the four cross-recessed screws securing the chassis to the underside of the transport casting, and the single screw holding the chassis to the side of the casting. DO NOT LOSE THE SPACER WASHER BETWEEN THE CHASSIS AND THE SIDE OF THE CASTING.

CAUTION

AVOID BENDING THE CHASSIS WIRING UNNECESSARILY AS THIS MAY BREAK INNER CONDUCTORS IN THE LEADS.



8298-9

Figure 6-8 Pre-amplifier Chassis

6.88 PINCH ROLLERS

NOTE

Do not lose the six Belleville washers under each pinch roller (see Figure 6-7).

Step 1: Unscrew the single slotted screw securing each pinch roller in place. Lift off the pinch rollers and the six Belleville washers under each.

6.89 PINCH ROLLER BEARINGS

CAUTION

UNNECESSARY REMOVAL OF THESE BEARINGS MAY RESULT IN DAMAGE TO THE BEARINGS.

Step 1: Using a suitable bearing extractor tool, remove the two bearings in each of the pinch rollers.

6.90 CAPSTAN AND BELTS

Step 1: Remove the drive belts by sliding the intermediate pulley assembly towards the capstan flywheel and slipping belts off the pulleys.

Step 2: To remove the capstan, unscrew the two socket head cap screws accessible from the top side of the transport casting (see Figure 6-7), BEING SURE TO SUPPORT THE CAPSTAN ASSEMBLY FROM THE UNDERSIDE. Slowly withdraw the capstan and attached flywheel, pressing on the top end of the capstan, from the underside of the casting. Avoid damaging the shaft or the bearing surface.

CAUTION

THE FLYWHEEL MAY BE REMOVED FROM THE CAPSTAN ONLY IF IT IS SECURED BY A SINGLE NUT (EARLIER MODELS USING FOUR SOCKET HEAD SCREWS MUST NOT BE DISASSEMBLED SINCE THE FLYWHEEL IS GROUND IN PLACE). FURTHER DISASSEMBLY MUST NOT BE UNDERTAKEN.

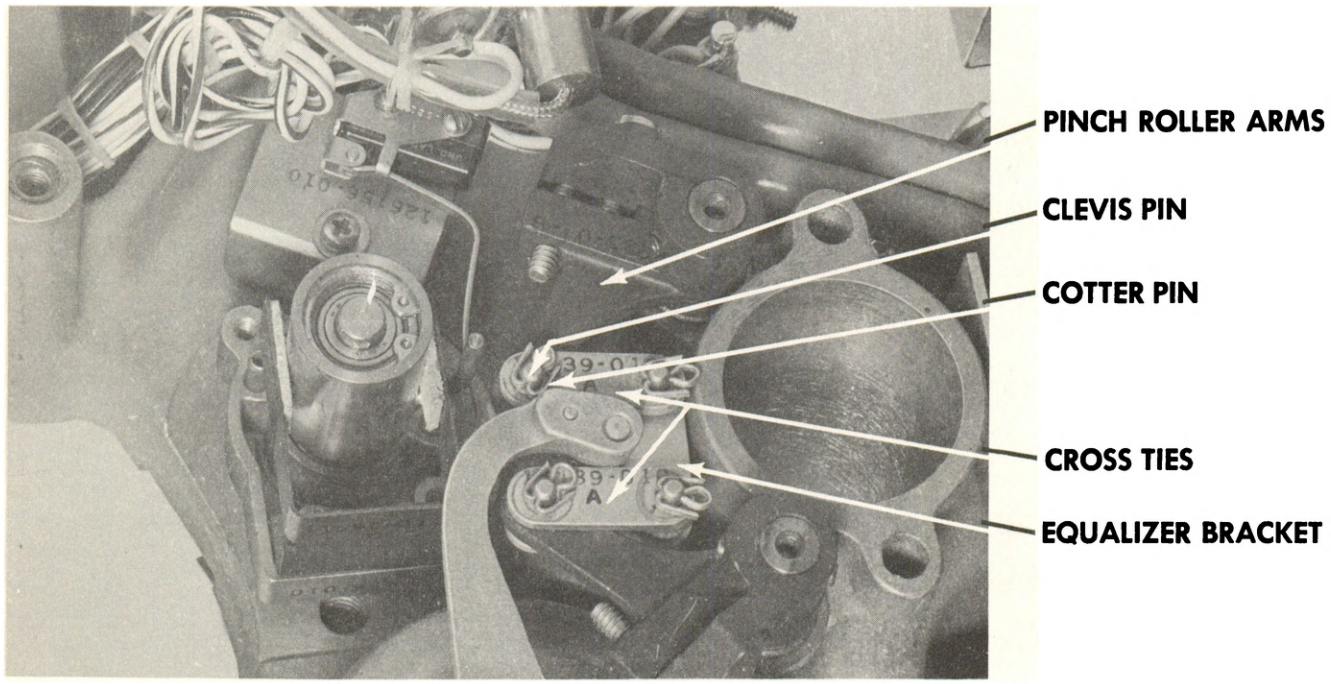


Figure 6-9 Pinch Roller Linkage

6.91 PINCH ROLLER LINKAGE

Step 1: Remove the cotter pin securing each cross tie to the pinch roller arm. See Figure 6-9.

Step 2: Remove the two clevis pins supporting the linkage on the ends of each pinch roller arm.

Step 3: Remove the linkage assembly from the solenoid arm.

Step 4: Remove the two remaining cotter and clevis pins joining the cross ties to the equalizer bracket.

NOTE

Do not use damaged cotter pins when re-assembling the pinch roller linkage.

6.92 DRIVE MOTOR PLATE

Step 1: Loosen the six slotted screws securing the fanning strip to TB1. Note the orientation of the fanning strip, i.e., red to red, blue to blue wires, etc., and then remove the fanning strip.

Step 2: Unscrew the two cross-recessed retaining screws holding the terminal strip mounting bracket to the drive motor plate. See Figure 6-10.

Step 3: Unscrew the four socket head cap screws securing the motor plate to the transport casting.

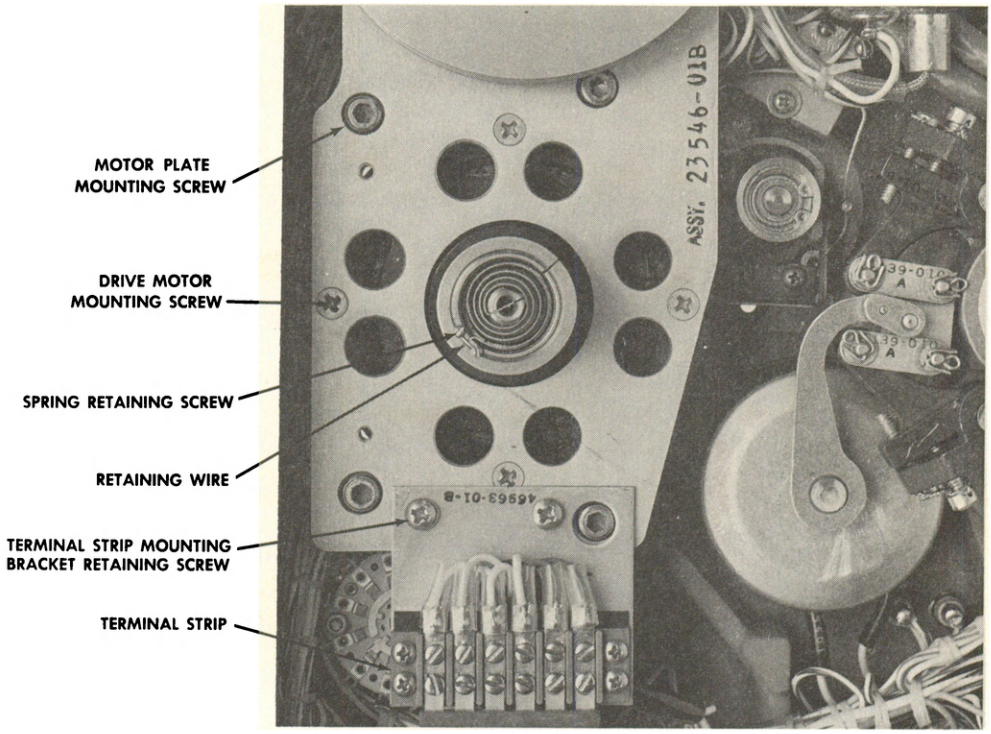
Step 4: Remove the drive motor plate with the attached intermediate pulley and motor from the transport casting.

6.93 CAPSTAN DRIVE MOTOR

Step 1: Unscrew the four flat-head screws securing the drive motor to the motor plate.

NOTE

These screws are assembled with loctite at the factory. When re-assembling, use loctite grade C or equivalent.



8298-12

Figure 6-10 Drive Motor Plate

6.94 DELAY RELAY ASSEMBLY: K9, CR2, CR7

Step 1: Identify the wire leads BEFORE UNSOLDERING the connections to the assembly.

Step 2: Unscrew the three cross-recessed screws securing the relay assembly to the underside of the transport casting. Remove the delay relay assembly.

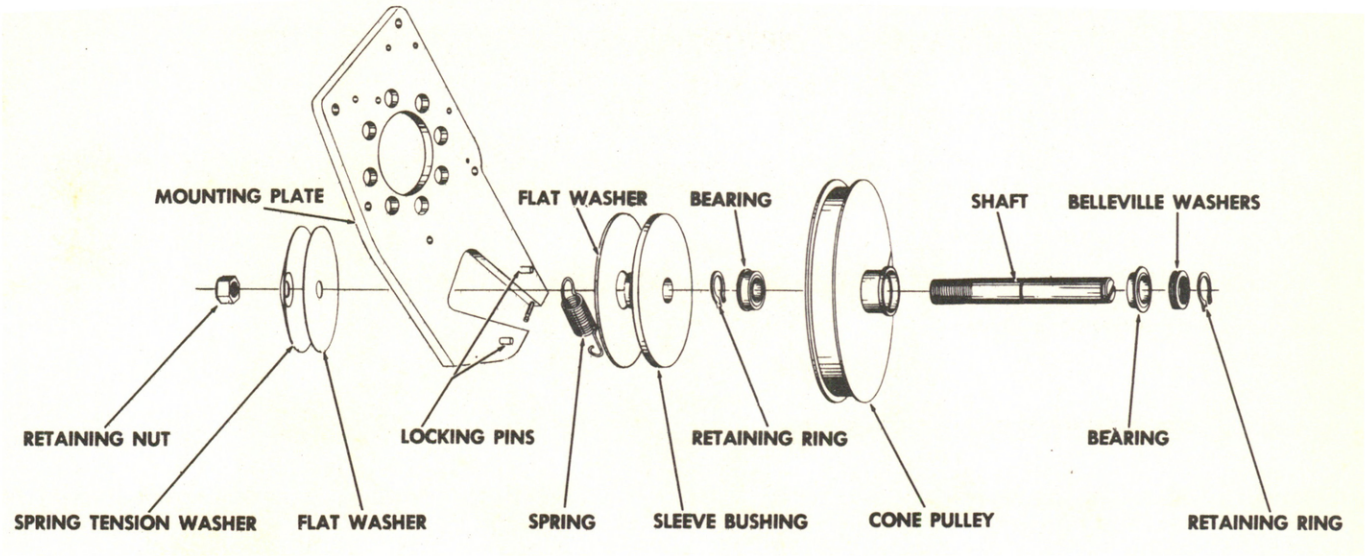
6.95 INTERMEDIATE PULLEY ASSEMBLY

Step 1: While preventing the shaft from turning with a flat-bladed screwdriver, unscrew the single hex nut, using an appropriate wrench.

Step 2: Remove the cup spring and teflon washer from the pulley shaft.

Step 3: Unhook the coil spring from the retaining pin.

Step 4: Remove the pulley shaft, the pressure plate, and the teflon washer from the drive motor plate.



50988

Figure 6-11 Intermediate Pulley Assembly

NOTE

During re-assembly, tighten the nut so that the pulley assembly does not wobble and the spring pulls the assembly against the stops.

6.96 SPEED SELECTOR SWITCH: S2

Step 1: Identify the wire connections BEFORE UNSOLDERING any of the leads to the switch.

Step 2: Loosen the socket head setscrew securing the speed indicator to the switch shaft and remove the indicator.

Step 3: Unscrew the single retaining nut holding the selector switch to the transport casting. Remove the switch.

6.97 OVERLAY PLATE

Step 1: Unscrew the 18 cross-recessed screws holding the two piece overlay plate onto the transport casting. Remove the overlay plate and handle blocks from the transport casting. It is not necessary to remove the small center section at this point.

6.98 INTERMEDIATE DISASSEMBLY

6.99 SUPPLY TENSION ARM TAPE GUIDE

Step 1: Loosen the single socket head setscrew, using a 1/16-inch hex wrench, securing the guide to the tension arm casting. Remove the guide from the casting. THE TENSION ARM GUIDE REQUIRES ADJUSTMENT AFTER RE-ASSEMBLY. SEE SECTION 6.129.

6.100 TORQUE MOTOR RESISTORS: R1, R4, R7, R8

Step 1: Identify the wire leads BEFORE UNSOLDERING the connections to the resistors.

Step 2: Unscrew the two cross-recessed screws securing each resistor to the transport casting. Remove the resistors.

6.101 FOLLOWER ARM RESISTOR ASSEMBLY (R3)

Step 1: Identify the wire leads BEFORE UNSOLDERING the connections from the variable resistor.

Step 2: Unscrew the two cross-recessed screws securing the resistor assembly to the transport casting.

6.102 TAKE-UP TENSION ARM SPRING ASSEMBLY

Step 1: Remove the two cross-recessed screws securing the spring assembly to the top of the transport casting. THE TAKE-UP BRAKE SETTING SHOULD BE CHECKED AFTER RE-ASSEMBLY. SEE SECTION 6.121.

6.103 SUPPLY AND TAKE-UP BRAKE BAND ASSEMBLIES

Step 1: Unscrew the outer hex nuts securing the ends of the brake band assembly to the tension arm and the anchor bracket respectively. Remove each brake band assembly. THE BRAKE BAND ASSEMBLIES REQUIRE ADJUSTMENT AFTER RE-ASSEMBLY. SEE SECTIONS 6.120, 6.121.

6.104 TORQUE MOTORS: B1 and B3

Step 1: Identify the wire leads BEFORE DISCONNECTING the three leads at each of the torque motor terminals.

Step 2: Unscrew the three socket head cap screws securing each torque motor to the transport casting. Remove each torque motor.

CAUTION

DO NOT ATTEMPT TO REMOVE THE COLLAR FROM THE MOTOR SHAFT. THIS IS GROUND IN PLACE.

NOTE

The perpendicularity of the torque motor shafts must be maintained in relation to the precision machined surfaces (bosses) of the transport casting when the torque motors are re-installed.

6.105 SUPPLY AND TAKE-UP TENSION ARMS

Step 1: Unscrew the single hex nut securing the supply brake band assembly to the tension arm.

Step 2: Remove from the underside of the transport casting the retaining ring securing the tension arm shaft to the casting.

Step 3: Remove the six Belleville washers. Remove the arm from the casting. (See Figure 6-4 for the method of re-assembly of Belleville washers.)

Step 4: REMOVE THE BEARINGS ONLY IF CONSIDERED FAULTY, AS DAMAGE TO THE BEARINGS MAY OTHERWISE OCCUR, using a suitable flanged bearing extractor tool.

Step 5: REMOVE THE BEARINGS ONLY IF CONSIDERED FAULTY, AS DAMAGE TO THE BEARINGS MAY RESULT, using a suitable flanged bearing extractor tool.

6.106 SUPPLY TENSION ARM SPRING ASSEMBLY

Step 1: Unscrew the two cross-recessed screws securing the spring assembly to the transport casting. Remove the spring assembly. THE SUPPLY BRAKES SETTING SHOULD BE CHECKED AFTER RE-ASSEMBLY. SEE SECTION 6.120.

6.107 SUPPLY RELEASE SOLENOID: L1

Step 1: Unsolder the solenoid leads from the two stand-off terminals.

Step 2: Unscrew the two hex nuts securing the solenoid to the top of the transport casting. Remove the solenoid.

6.108 DRIVE MOTOR CAPACITOR: C5

Step 1: Identify the wire leads BEFORE UNSOLDERING the connections to the motor capacitor.

Step 2: Unscrew the single cross-recessed screw securing the capacitor from the underside of the transport. This screw also partially secures the relay bracket mounting K6, K7, R10.

Step 3: Unscrew the two remaining cross-recessed screws securing the capacitor from the top of the transport casting. Remove the capacitor.

6.109 FINAL DISASSEMBLY

6.110 ACTUATOR ASSEMBLY

Step 1: Remove the hook from the collar of the actuator assembly by rotating the hook in an upward direction.

Step 2: Remove two cross-recessed screws securing the assembly from the top of the transport, and one cross-recessed screw securing the assembly from the bottom of the transport.

Step 3: Remove the actuator assembly from the underside of the transport casting.

6.111 TRANSPORT CONTROL SUB-ASSEMBLY MOUNTING BRACKET

Step 1: Remove the three cross-recessed screws securing the bracket to the underside of the transport casting.

Step 2: Remove the two cross-recessed screws securing the receptacle connector to the bracket and remove the bracket.

6.112 SAFETY SWITCH: S1

Step 1: Unsolder the connections to the safety switch.

Step 2: Unscrew the two cross-recessed screws securing the safety switch to the transport casting and remove the switch assembly from the underside of the transport. See Figure 6-12.

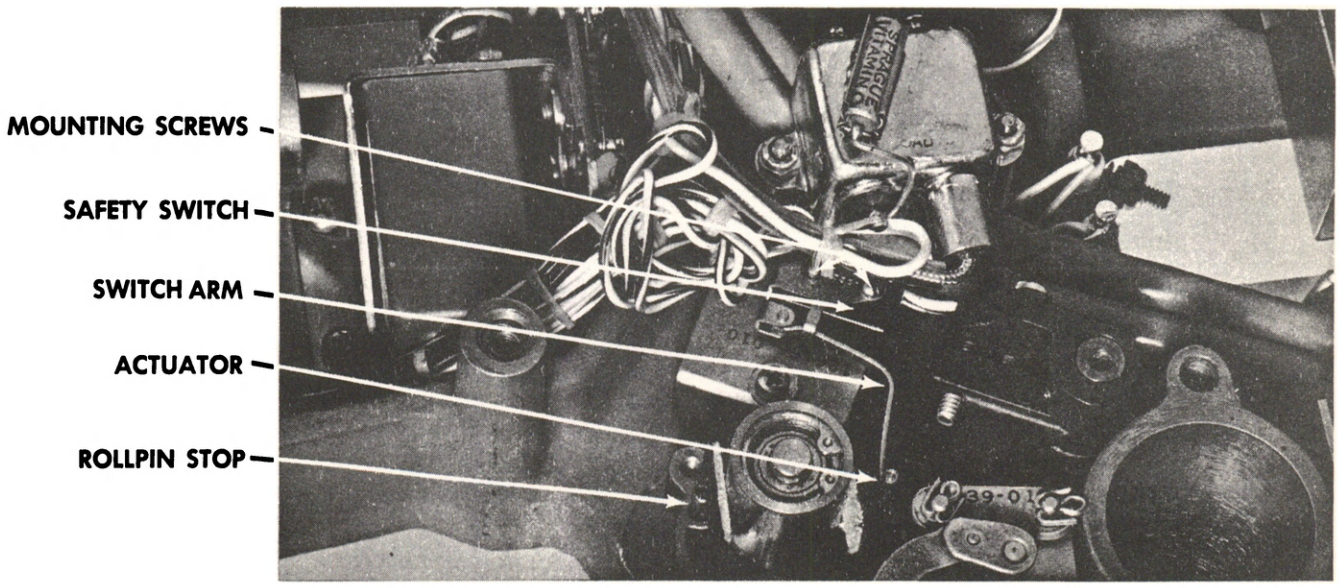
6.113 RELAY ASSEMBLY: K1, K2, K3, K4, K5, C1

Step 1: Unscrew the single cross-recessed screw securing the relay assembly to the underside of the transport casting.

Step 2: Unscrew the two cross-recessed screws securing the relay assembly to the side of the transport casting.

Step 3: Remove the relay assembly from the transport casting to the extent of the wiring harness.

Step 4: Identify the wire leads BEFORE UNSOLDERING any or all of the connections to the relay assembly. Remove the relay assembly.



8298-15

Figure 6-12 Safety Switch

6.114 TAKE-UP TORQUE MOTOR R-F FILTER: FL2

Step 1: Remove the cam follower from the take-up tension arm by removing the two socket head cap screws and washers which secure the follower to the arm.

Step 2: Remove the two flat-head screws securing the stand-offs on which the filter mounts, from the top of the transport casting.

Step 3: Disconnect the two leads from the filter at the torque motor and unsolder the three black wires from the LINE terminal.

Step 4: Unscrew the two stand-offs from the clinch nuts on the filter. Remove the filter.

6.115 TAKE-UP BRAKE RELEASE SOLENOID: L3

Step 1: Unsolder the two wires from the solenoid from the two insulated stand-offs adjacent to the solenoid.

Step 2: Remove the two nuts, securing the solenoid to the transport casting, from the top side of the transport.

NOTE

After replacement of the solenoid, the take-up brake settings must be checked. See section 6.7.

6.116 OVERLAY CENTER SECTION

Step 1: Remove the center tape guide, supply pinch roller, and supply guide. DO NOT lose the shims (if present) under the center guide. The center guide determines the tape height past the heads.

Step 2: Remove the single cross-recessed screw securing the center section of the overlay to the frame casting and lift off the center section.

6.117 CAPSTAN SOLENOID: L2

Step 1: Unscrew the two hex nuts securing the solenoid to the transport casting.

Step 2: Unsolder the solenoid leads from the two stand-off terminals.

Step 3: Remove the solenoid from the underside of the casting.

NOTE

After replacement of the solenoid, check pinch roller grip and adjust if necessary. See sections 6.21, 6.16.

6.118 ADJUSTMENTS

WARNING

UNLESS OTHERWISE SPECIFIED, ALL POWER MUST BE REMOVED FROM THE TRANSPORT DURING ADJUSTMENTS.

6.119 GENERAL PROCEDURES. In performing adjustments on the Tape Transport, certain parts must be disassembled to gain access to the part under test. In all cases, disassembly and re-assembly should follow the Progressive Disassembly Chart, Figure 6-21, in conjunction with Figures 6-22, 6-23, and 6-24. Disassembly for a specific adjustment is required only to the point indicated in the following procedures.

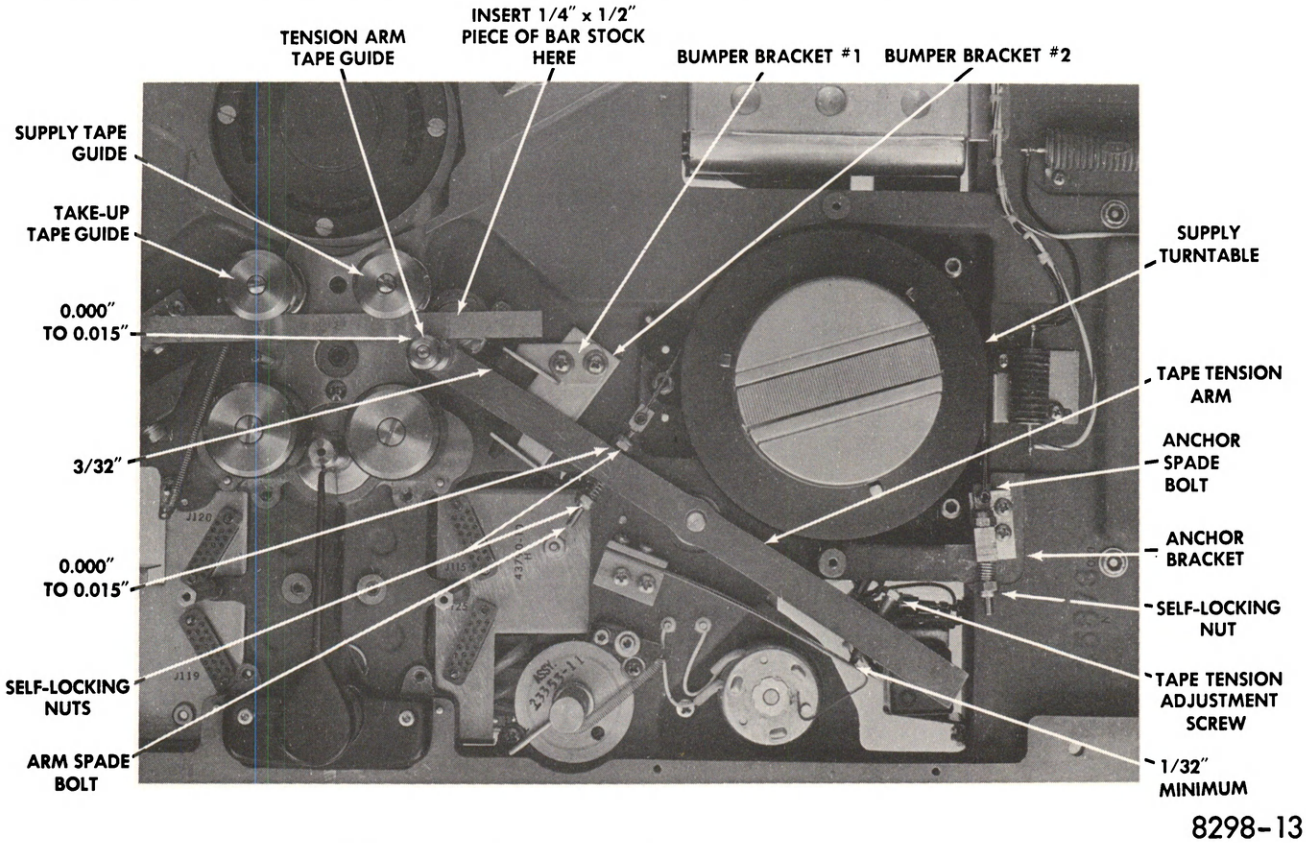


Figure 6-13 Supply Brake Adjustment

6.120 SUPPLY BRAKE ADJUSTMENT

NOTE

For all adjustments secure brake band to prevent twisting.

Step 1: Remove the supply section of the overlay plate.

Step 2: Remove the center guide. DO NOT lose the shims (if any) under the guide. This guide determines the tape height past the heads.

Step 3: Place a 1/4-inch by 1/2-inch piece of clean, flat bar stock, approximately 5 inches long, across the supply and take-up guides as shown in Figure 6-13.

Step 4: Adjust tape tension adjustment screw for approximately 1/4" clearance between tension arm and leaf springs.

Step 5: Adjust bumper bracket No. 1 so that the tension arm guide just touches the parallel bar. Remove the parallel bar.

Step 6: Adjust bumper bracket No. 2 for 3/32" clearance between tension arm and bumper. Adjust to this dimension, if necessary, by loosening the bumper bracket screws and repositioning bumper bracket No. 2, being careful not to change the position of bracket No. 1.

Step 7: Adjust the tape tension adjustment screw so that the tension arm just leaves rubber bumper No. 1 when pulled with a force of 12 - 16 ounces. Some adjustment is available by loosening the screws securing the spring mounting block and rotating the mounting block as required.

Step 8: Simulate supply brake release and determine that clearance between the leaf springs and the tape tension adjusting screw is a minimum of 1/32 inch with arm held against bumper bracket No. 2.

Step 9: Mount a reel of tape as shown in Figure 6-1 and measure force required to pull tape from reel. The force should be 8 - 11 ounces. Adjust the tape tension adjustment screw as required to achieve this reading.

Step 10: Adjust self locking nut on anchor spade bolt so that there will be approximately three threads showing between shoulder of spade bolt and edge of nut.

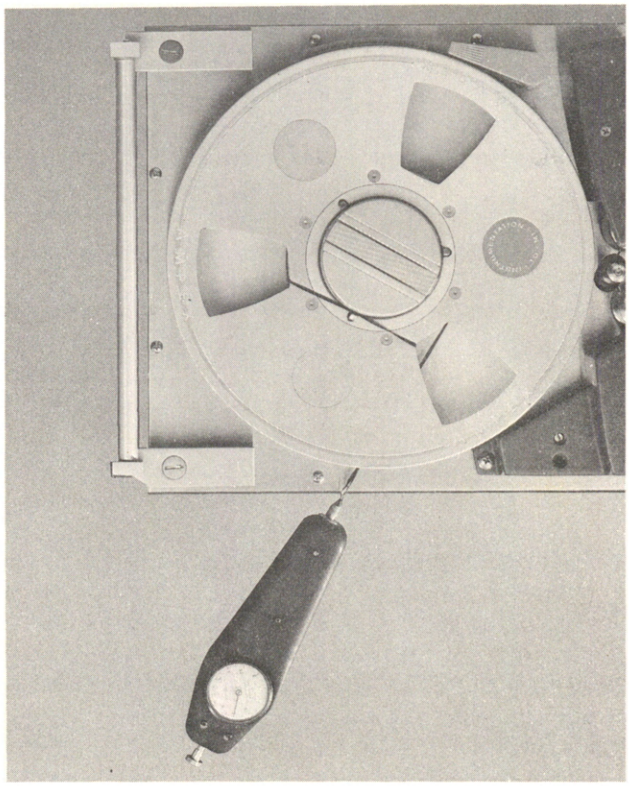
Step 11: Adjust the other self-locking nut on this spade bolt so the high tension spring is compressed to approximately 7/32 inch.

Step 12: Position self-locking nut (on the spring side) on the arm spade bolt until the low tension spring is compressed to approximately 9/32 inch.

Step 13: Adjust the self-locking nut, closest to the shoulder of the arm spade bolt, for a clearance of .005 to .015 inch between the nut and the arm.

Step 14: Operate the Tape Transport in FAST FORWARD MODE for a few minutes, applying a slight brake pressure, to "wear in" the brake.

Step 15: Attach a 3-foot length of string to an empty reel mounted on the take-up turntable (see Figure 6-14). Wind the string around the hub several times so that it will unwind from the reel in counterclockwise direction when pulled by a spring scale. A reading of 2-1/2 to 3-1/2 pounds is required. If reading is not achieved, adjust the high spring elastic stop nut as required.



X8143-3

Figure 6-14 Braking Effect Measurement

Step 16: Wind the string around the reel hub several times so that the reel will rotate clockwise when pulled with the spring scale. A reading of 12-16 ounces should be observed. If not, adjust the low spring elastic stop nut as required.

NOTE

IF ABOVE SETTINGS CANNOT BE OBTAINED, PERFORM STEPS 17-21.

Step 17: Remove brake band by removing anchor bracket and elastic stop nut on other end of band.

CAUTION

DO NOT STRAIGHTEN OUT BAND, OTHERWISE THE LINING MATERIAL WILL SEPARATE FROM BAND.

Step 18: If brake lining is glazed, sand lightly.

Step 19: Form band to conform to brake drum.

Step 20: Install brake band.

Step 21: Repeat Steps 9 through 16.

Step 22: Replace the overlay plate and center guide. If no further measurements and adjustments are to be made, remove the test equipment and replace the overlay plate. If any of the following adjustments are also to be performed, the overlay plate should not be replaced at this point.

6.121 TAKE-UP BRAKE ADJUSTMENT

NOTE

For all adjustments secure brake band to prevent twisting.

Step 1: Remove the overlay plate on the take-up side of the transport (see Figure 6-15).

Step 2: The cam should be approximately parallel to the cam follower. If not, the cam can be moved by loosening the single setscrew securing it to the shaft of its solenoid. The brake release arm spring should hold the cam and cam follower in close contact.

Step 3: Adjust self-locking nut on anchor spade bolt so that there will be approximately three threads showing between shoulder of spade bolt and edge of nut.

Step 4: Adjust the other self-locking nut on this spade bolt so the high tension spring is compressed to approximately 7/32 inch.

Step 5: Position the self-locking nut (on the spring side) on the arm spade bolt until the low tension spring is compressed to approximately 9/32 inch.

Step 6: Adjust the self-locking nut, closest to the shoulder of the arm spade bolt, for a clearance of .005 to .015 inch between the nut and the arm.

Step 7: Operate the Tape Transport in the REWIND MODE for a few minutes, stopping and starting the transport to "wear in" the brake.

Step 8: Attach a 3-foot length of string to an empty reel mounted on the take-up turntable. Wind the string around the hub several times so that it will unwind from the reel in clockwise direction when pulled by a spring scale. A reading of 2-1/2 to 3-1/2 pounds is required. If reading is not achieved, adjust the high spring elastic stop nut as required.

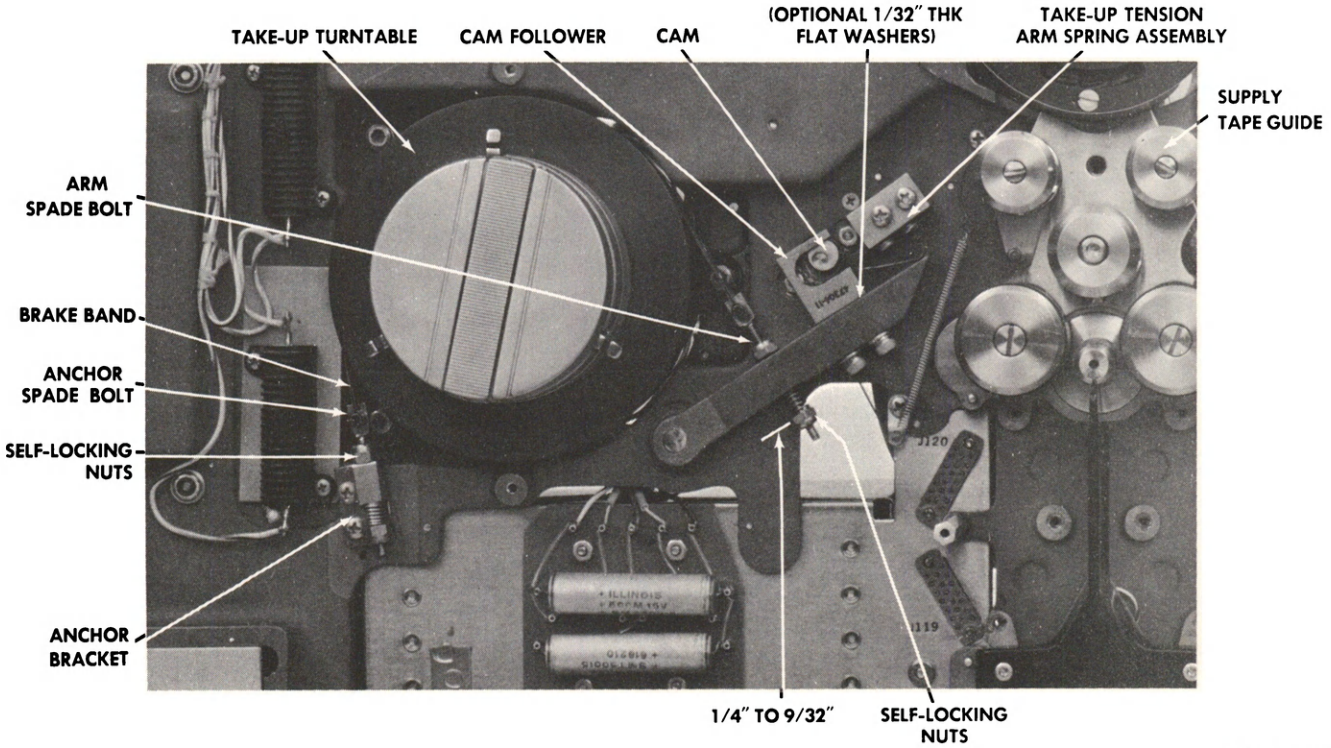


Figure 6-15 Take-up Brake Adjustment

Step 9: Wind the string around the reel hub several times so that the reel will rotate counterclockwise when pulled with the spring scale. A reading of 12 - 16 ounces is required. If this reading is not obtained, adjust the low spring self-locking nut as required.

NOTE

If above settings cannot be obtained perform steps 10-14.

Step 10: Remove brake band by removing anchor bracket and self-locking nut on other end of band.

CAUTION

DO NOT STRAIGHTEN OUT BAND OTHERWISE THE LINING MATERIAL WILL SEPARATE FROM BAND.

Step 11: If brake lining is glazed, sand lightly.

Step 12: Form band to conform to brake drum.

Step 13: Install brake band.

Step 14: Repeat Steps 3 through 9.

Step 15: Replace the overlay plate. If no further measurements and adjustments are to be made, remove the test equipment and replace the overlay plate. If any of the following adjustments are also to be performed, the overlay plate should not be replaced at this point.

6.122 ACTUATOR ARM ASSEMBLY ADJUSTMENT

Step 1: Remove the take-up section of the overlay plate.

Step 2: Use a spring scale to check that the spring exerts a force of approximately 3 ounces on the arm when the arm is rotated in a clockwise direction. The force must be sufficient to return the arm to the static position when released from any position. If the force is not sufficient adjust spring anchor until the arm returns to a static position from any release position.

6.123 SAFETY SWITCH ADJUSTMENT

Step 1: Check the position of the actuator arm assembly as outlined in Section 6.122 above.

Step 2: Bend the switch arm so that the switch is actuated by the actuator just before the actuator hits the rollpin stop. (See Figure 6-12.)

6.124 TORQUE MOTOR POTENTIOMETER R10 ADJUSTMENT

Step 1: Simulate the closure of the safety switch by wrapping a rubber band between the guide on the arm and the screw on the motor cover as shown in Figure 6-2.

Step 2: Attach a 3-foot length of string to an empty reel mounted on the take-up turntable. Wind the string several times around the hub of the reel so that the string will unwind from the reel when rotated in a clockwise direction. Attach a 0-5 lb. scale to the string.

Step 3: Set the speed selector in the 60 ips position and apply power to the transport.

Step 4: Depress the FAST FORWARD pushbutton and measure the force exerted on the string. The scale reading should be 2-3/4 to 3 lb. Adjust R10 to attain this value if necessary.

Step 5: Depress the STOP pushbutton. Remove the rubber band and test equipment.

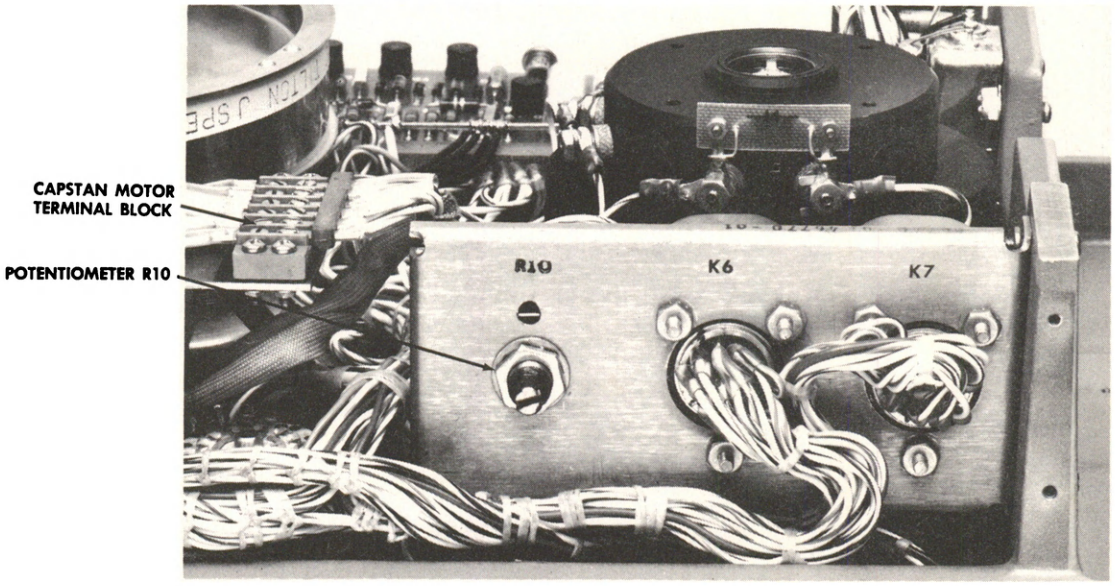


Figure 6-16 Torque Motor Potentiometer R10

8143-12

Step 6: With all the guides and pinch rollers in place, mount a full reel of tape onto the supply turntable and complete the normal tape threading path.

Step 7: Depress the FAST FORWARD pushbutton, and measure the time to wind all the tape onto the take-up reel. Time should be within the specification given in Chapter One. If necessary, re-adjust R10 to give the correct fast-forward time, but do not exceed the limits measured in Step 4.

Step 8: Remove power from the transport.

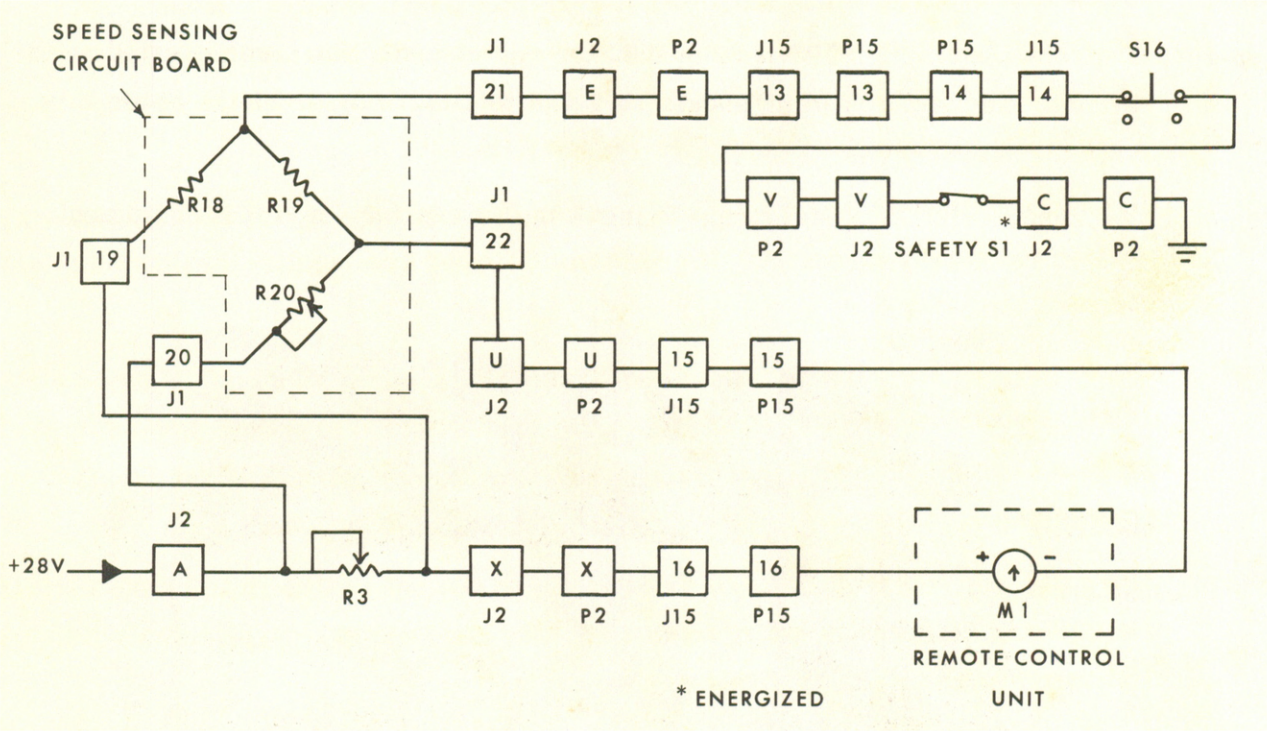


Figure 6-17 Tape Remaining Indicator Circuit Tracing Diagram

6.125 TAPE REMAINING ADJUSTMENT (If Remote Control Unit is Used)

6.126 If the Remote Control Unit forms part of the system, the following procedure can be used to adjust the Tape Remaining Indicator. Figure 6-17 shows the manner in which the tape remaining circuit is energized.

Step 1: With the overlay plate removed, replace the tape follower arm and set the arm in the park position.

Step 2: Check that the remote control cable is connected to the REMOTE connector on the Frame Assembly.

Step 3: Place a full reel of tape onto the supply turntable and set the tip of the tape follower arm against the full tape pack.

Step 4: Apply power to the transport.

Step 5: Check that the tape remaining indicator gives a F(ull) reading. If necessary, loosen the clamping screws securing the follower arm potentiometer R3 to the casting and rotate the potentiometer so that the indicator gives the correct reading. Tighten the clamping screws. See Figure 6-18.

Step 6: Place the follower arm in the park position and replace the full reel with an empty reel on the supply turntable. Release the follower arm so that its tip rests against the reel hub.

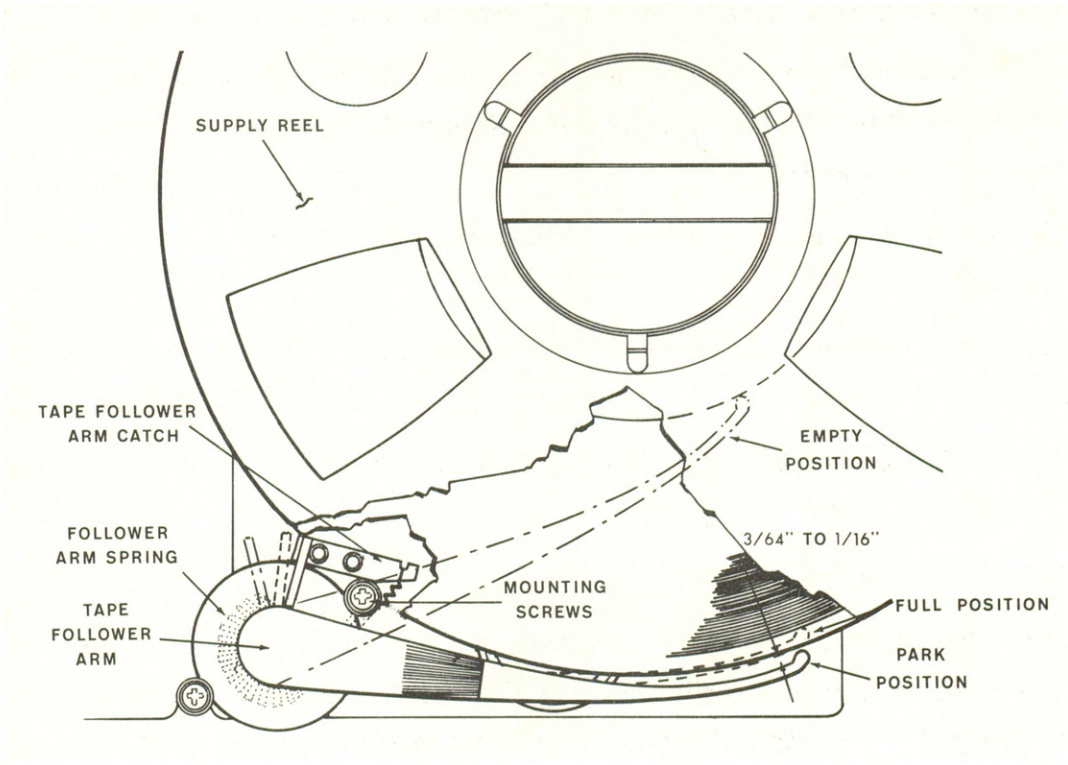
Step 7: Check that the tape remaining indicator gives an E(mpty) reading. If necessary adjust potentiometer R20, mounted on the Transport Control Sub-Assembly (Speed Sensing Circuit) to obtain the required reading. See Figure 6-19 for location of potentiometer R20.

Step 8: Move the tape follower arm from the empty to the full positions and observe that the tape remaining indicator gives an appropriate reading. Repeat Steps 3 through 7 above until satisfactory readings are attained.

Step 9: Remove power from the transport.

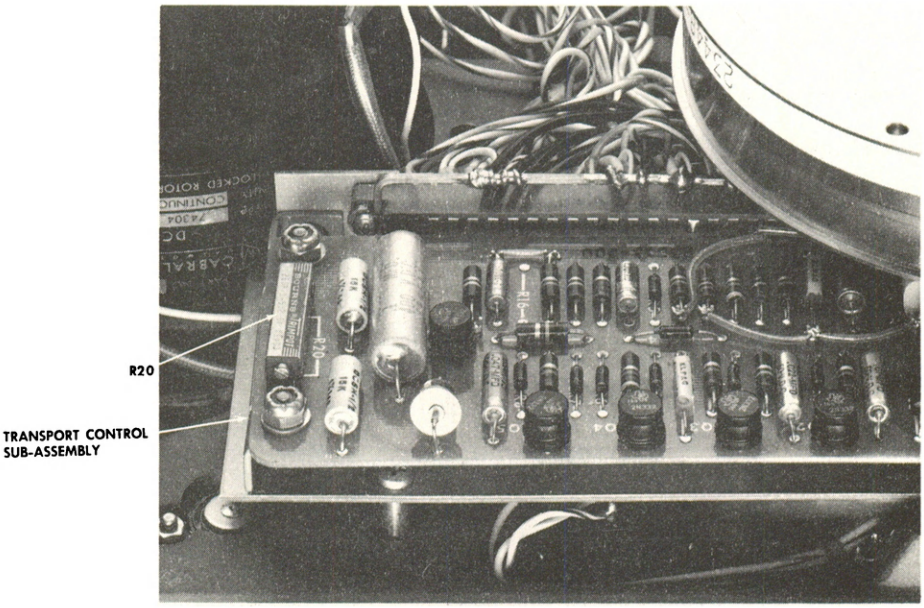
Step 10: Remove tape follower arm and replace overlay plate.

Step 11: Replace the tape follower arm and make sure that 3/64 to 1/16-inch clearance exists between the tip of the follower arm, when the arm is in the park position, and the periphery of a tape reel flange when a reel is placed on the supply turntable.



50990

Figure 6-18 Tape Follower Arm Adjustment



8143-15

Figure 6-19 Location of Potentiometer R20

Step 11: (Continued)

Check also that the tape follower arm moves freely and smoothly throughout its travel.

6.127 PINCH ROLLER GRIP ADJUSTMENT

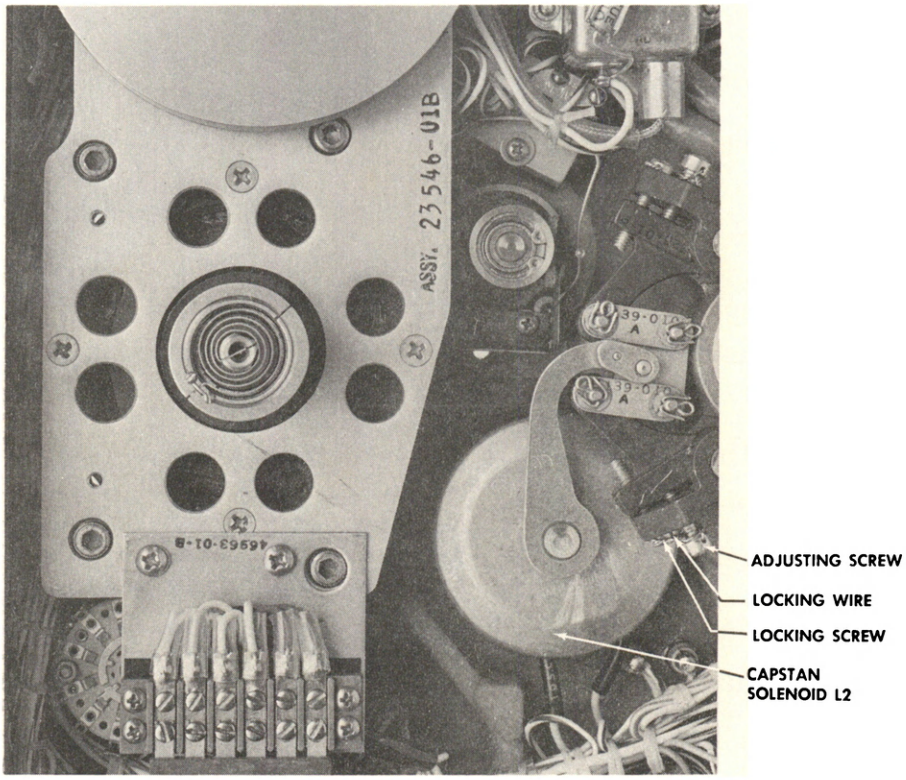
Step 1: Remove the pinch rollers and the capstan from the transport.

Step 2: Refer to Figure 6-20. Remove the locking wire, securing the adjustment screw and the locking screw in each arm.

Step 3(a): To increase the pinch roller grip, loosen the locking screw as required by turning in a counterclockwise direction. Turn the adjustment screw in a clockwise direction. Tighten the locking screw.

Step 3(b): To decrease the pinch roller grip, turn the adjustment screw in a counterclockwise direction. Tighten the locking screw.

Step 4: Replace the capstan and pinch rollers.



8298-12

Figure 6-20 Pinch Roller Grip Adjustment

Step 5: Check the pinch roller grip as outlined in Section 6.21. (It is not necessary to have the head assemblies mounted in place.)

Step 6: When the correct adjustment is indicated, and with power removed from the transport, secure the adjustment screw and locking screw in each arm with the locking wire.

6.128 BELT TENSION ADJUSTMENT

Step 1: Remove the capstan and the drive motor plate.

Step 2: Hold the belt idler shaft by inserting a flat-bladed screwdriver in the slot at the end of the shaft. Adjust the nut at the other end of the shaft so that the belt idler can be moved smoothly against the restraining action of the belt tensioning spring in all directions to which the action of the spring is opposed. The belt idler must return smoothly to its static position against the pins without external assistance. The adjustment should be such that the cup spring exerts sufficient pressure to absorb shaft motion other than in the plane of the motor plate.

Step 3: Replace the drive motor plate and the capstan.

Step 4: Replace the drive belts.

Step 5: Check belt tension as outlined in Section 6.22.

6.129 TAPE TRACKING ADJUSTMENT

6.130 Tape tracking may vary with respect to thickness and composition of the magnetic recording tape. Further, it is a function of correct height settings and the perpendicularity and parallelism of the supply and take-up tape guides, tension arm guide, turntables, magnetic head assemblies and the turnaround idler assembly. If any of the tape guiding components have been removed or replaced it may be necessary to recheck the tape tracking.

Step 1: Remove the supply section of the overlay plate.

Step 2: Mount a full reel of tape on the transport and thread the tape for normal operation (see Figure 3-1).

Step 3: Rotate the take-up reel manually and observe the tape as it passes over the guiding surfaces. The supply and take-up guides have a limited range of adjustment available by rotating the self-locking adjusting screws which raise and lower the guides.

Step 3: (Continued)

The range available is 0 to .010 inch. If this is not sufficient, shims can be added or removed as required from under the two wavy washers. The final position of the guides should be such that 1/3 or less of a revolution of the adjusting screw will bottom the guide. If the guide does not bottom in 1/3 revolution or less, the wavy washers are not compressed sufficiently to firmly position the guide.

Step 4: Rotate the adjusting screws on the guides while manually pulling tape until the tape is centered in the center guide. UNDER NO circumstances add or remove shims from under the center guide. This guide determines the height of tape as it moves past the heads.

Step 5: After the tape is tracking in the center guide, adjust the tension arm guide until the tape tracks on the supply guide.

Step 6: Repeat the above steps with the pinch rollers engaged at 1-7/8 ips. If the tape tracks satisfactorily at 1-7/8 ips, it should track at the higher speeds since 1-7/8 ips is the most difficult speed at which proper tape tracking is attained.

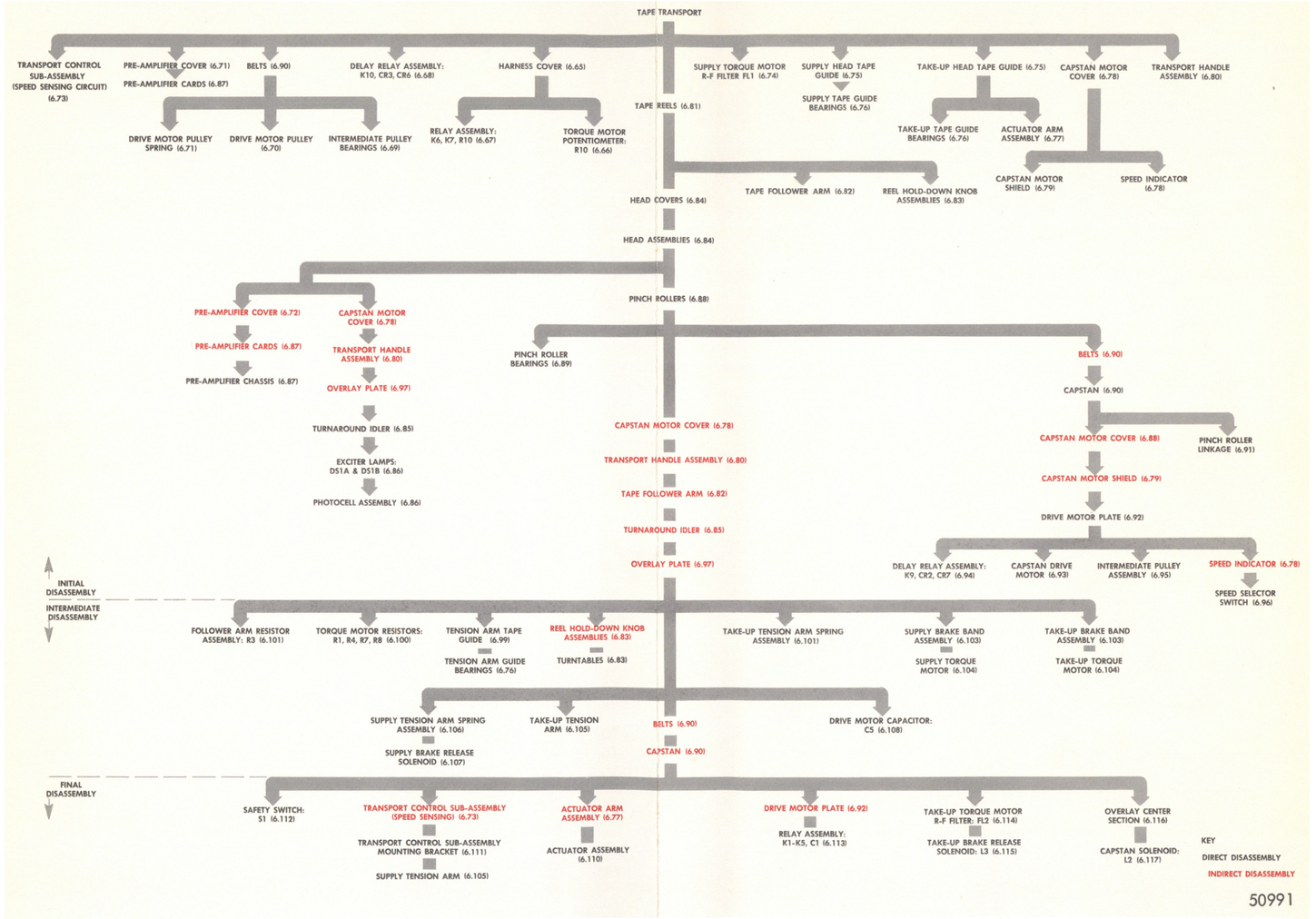
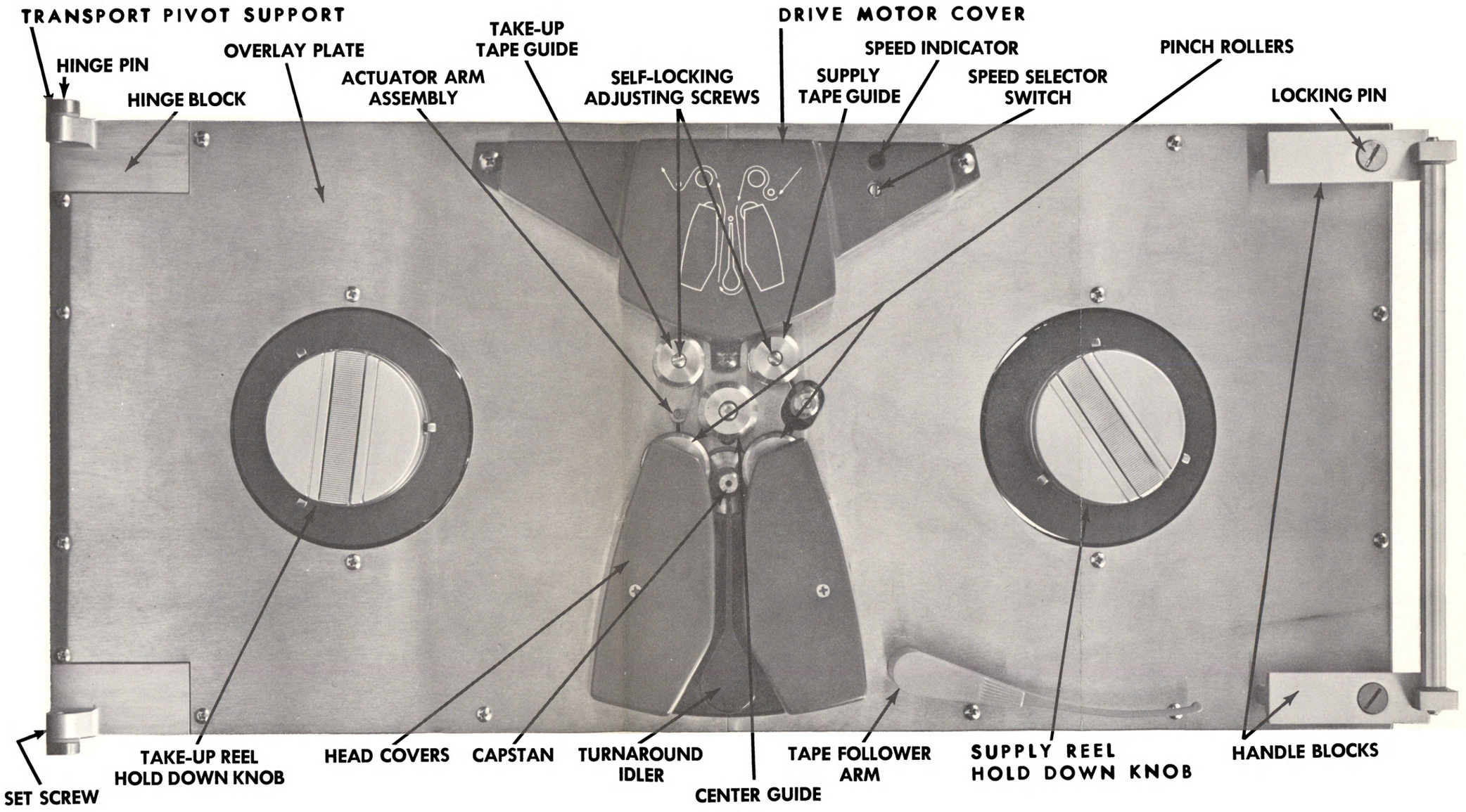
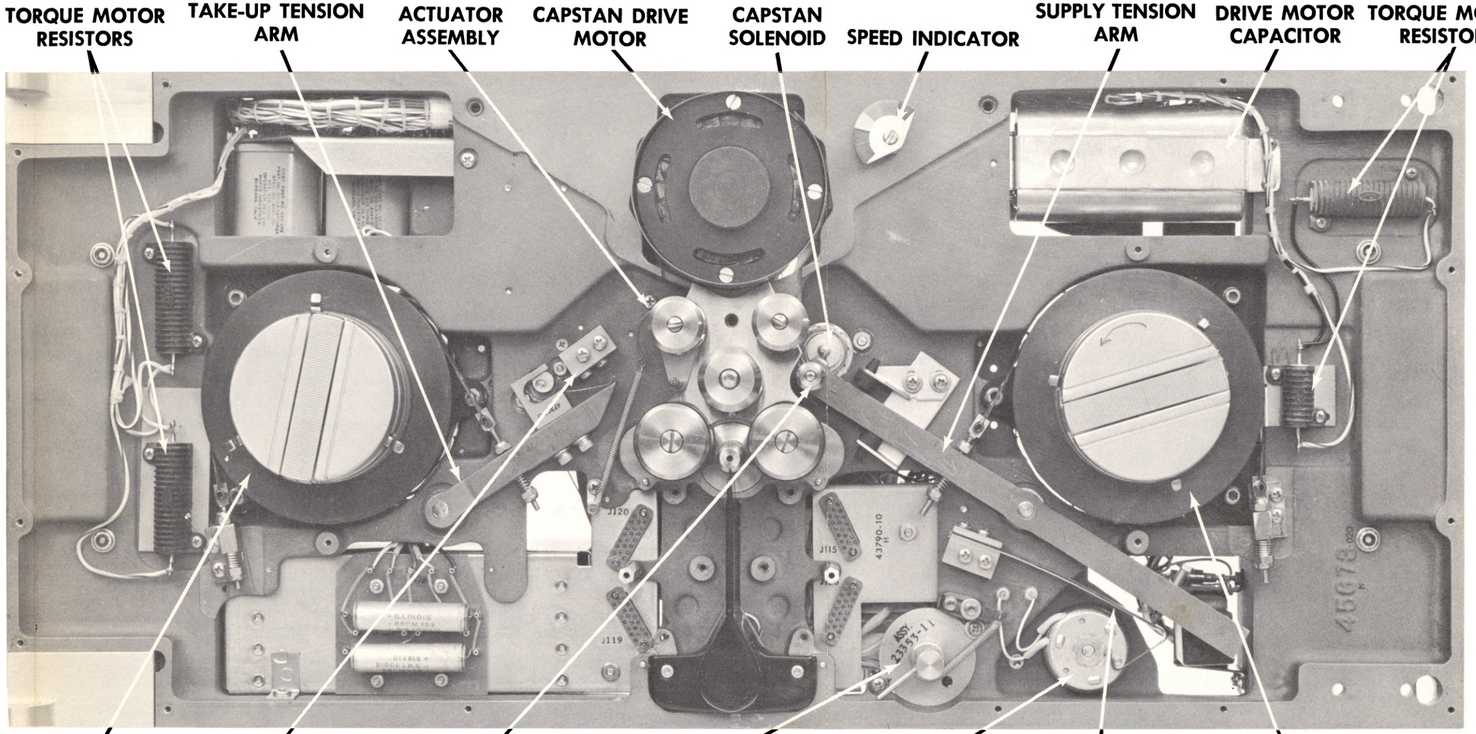


Figure 6-21 Progressive Disassembly Chart



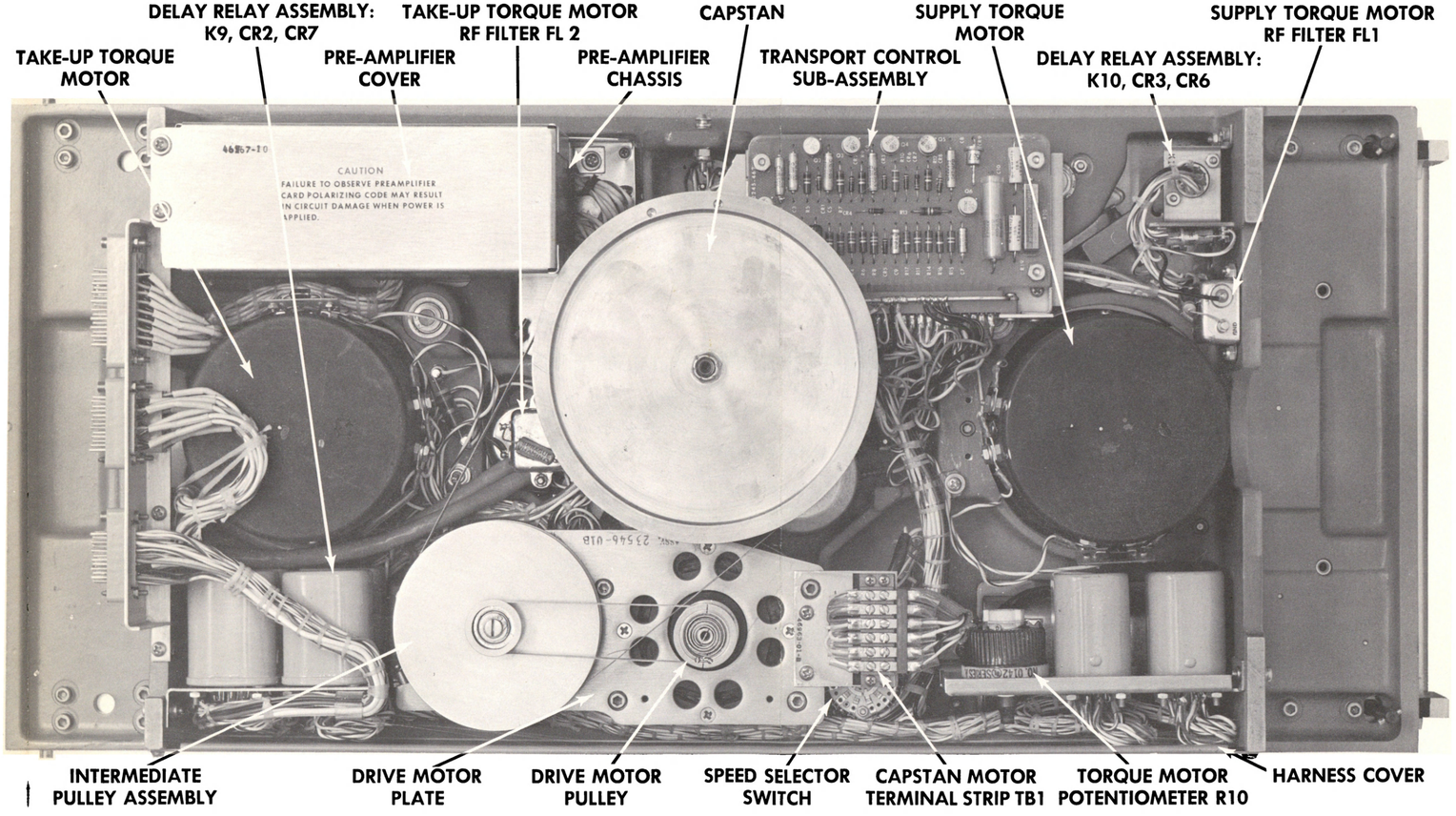
8298-2

Figure 6-22. Tape Transport, Top View



8298-3

Figure 6-23 Tape Transport, Top View With Overlay Plate Removed



8298-4

Figure 6-24 Tape Transport, Bottom View

CHAPTER SEVEN

PARTS LISTS

The Parts Lists for the CP-100 Recorder/Reproducer, provided in this part of the manual, are based on a breakdown by catalog number for each complete standard unit, card or assembly. The catalog number on the identification plate may be found in the following Table of Contents which is compiled in increasing numerical order. The actual Parts Lists may be located in the same order.

TABLE OF CONTENTS

NOTES:

(1) Title & Catalog Number of Standard Unit

This corresponds to the information on the identification plate of the unit. Each complete Parts List may be located at the end of this chapter by the catalog number.

(2) Reference Number

This reference number is of two types:

(a) Circuit reference symbols corresponding to the identification on the schematic diagram and the silk-screening on the unit or any of its printed circuit boards for electronics parts e.g. resistors, capacitors, etc.

(b) A numerical reference symbol assigned to mechanical and/or electro-mechanical parts for easy identification on the Photoview (when provided after each complete Parts List). These numbers are of the form: 1, 2, 3, 4, 5, etc. which correspond to the main assembly parts of a complete catalog item or 4-1, 4-2, 4-3, etc., 5-1, 5-2, etc., which correspond to the piece parts of a main assembly.

Where there is a further breakdown of piece parts of sub-assemblies of assemblies, the indentation of the description (Note 4) indicates the degree of breakdown. For items with circuit reference symbols, the parts list is arranged in increasing alpha-numerical order of the circuit reference symbol.

For items with numerical reference symbols, the parts lists are arranged in alphabetical order by the noun name of the part. Where there are two or more parts with the same noun name, then the arrangement is numerical by Ampex Part No. (Note 3).

(3) Ampex Part Number

This is the most important designation of the complete parts list. These parts numbers are of two types:

(a) A 5, 6, or 9-digit number with or without a "dash" number suffix. These are assigned to parts manufactured by and/or subject to quality control of Ampex Corporation.

(b) A 3-digit number with a 3-digit "dash" number suffix. These are assigned to parts purchased by Ampex Corporation according to the Vendor & Part No. (Note 5) or an equivalent, and which may be subject to quality control inspection by Ampex Corporation.

TO EXPEDITE PARTS PROCUREMENT ALWAYS QUOTE THE COMPLETE AMPEX PART NO.

(4) Description of Part

This is an abbreviation explanation of each part used in the complete catalog item, to assist the customer in identifying parts which may require replacement.

Where the same part is described earlier in the SAME parts list, then the description "Same as XX-XXX" is given and refers to the reference symbol which has the initial concise explanation.

As mentioned previously (Note 2), the description of a part may be indented to indicate that the part is a breakdown of a sub-assembly.

(5) Vendor & Part No. or Military Part No.

This is the identification by which Ampex Corporation has purchased a part from one or more available vendors. Any suitable equivalent may be used in the procurement of parts so identified.

(6) Non-Accumulative Quantity of Piece Parts per Assembly

This quantity corresponds to the number each part (identified by its reference symbol) is used in the complete catalog item and shown in the Photoview (when provided).

(7) Revision Key

This is used on the following basis:

A:	addition	applies to the incorporation of a new part because of design changes to the complete catalog item and required in the latest versions.
C:	change	applies to the direct substitution of a part because of design changes to the complete catalog item, not immediately recognizable by its abbreviated description, and required in the latest versions.
D:	deletion	applies to parts which have been deleted by design changes to the complete catalog item and which are no longer required in the latest versions.
PC:	part no. change	applies to Ampex-manufactured parts primarily, not immediately recognizable by the abbreviated description. It is used also with Ampex-purchased parts where a direct substitution has been made, because of design changes to the complete catalog item, and the description may not have altered appreciably; required on latest versions.
QD:	quantity decrease	applies to a decrease in the quantity of a part, required by design changes to the complete catalog item and the excess is no longer required in the latest versions.
QI:	quantity increase	applies to an increase in the quantity of a part, required by design changes to the complete catalog item, and the increase is required in the latest versions.

(8) Serial No. Effectivity or Date of Effectivity

This information is provided to assist the customer, when ordering replacement parts, as to the effectivity of the change (see Revision Key, Note 7). The serial no. effectivity is quoted when known, and corresponds to the serial number of the complete catalog item found on the identification plate. When a serial no. is not known, the earliest date when the change was made is quoted.

(9) Number of Parts List Pages

This indicates how many pages comprise the complete Parts List for each catalog item.

(10) Control Number

This is for Ampex Corporation use only.

(11) Revision & Date of Complete Parts List

This is for Ampex Corporation use only (when applicable).

PARTS LIST FOR: CP-100 TAPE TRANSPORT (1)

1-inch: CATALOG NO. 46365-60
1/2-inch: CATALOG NO. 46365-60

(7) REF. NO.	(2) AMPEX PART NO. (3)	(4) DESCRIPTION	(8)	(5)	(6) NO/ ASSY.
		CAPACITORS			
C2	037-037	Fixed, tantalum, 80 µf, -15 to +75% tol, 60v dc		Mallory XTHS-806V060POK	1
		--			
		--			
C4	037-106	Fixed, tantalum, 60 µf, -15 to +50% tol, 50v dc		General Electric 62F404	1
C5	23556-01	Motor, fixed, 4.5 µf			1
C6	037-106	Same as C4			
		DIODE SEMICONDUCTORS			
CR1	013-305	Silicon		International Rectifier 1N1516A	1
CR2	013-050	Silicon, power		General Electric 1N537	1
CR3	013-050	Same as CR2			
		RESISTORS			
	R1	043-034	Fixed, wirewound, 5 ohms, ±3% tol, 50w		Dale RH50	1
	R2	041-345	Fixed, composition, 51 ohms, ±5% tol, 1/2 w		RC20GF510J	1
C	R2	041-540	Fixed, composition, 36 ohms, ±5% tol, 1/2 w	Effective 8-23-63	RC20GF360J	1
	R4	041-251	Fixed, composition, 100 ohms, ±5% tol, 1/2 w		Allen Bradley EB1012	1
PC	R4	041-003	Fixed, composition, 100 ohms, ±5% tol, 1/2 wa	Effective 8-23-63	RC20GF101J	1
		--				
		--				
		--				
A	R10	044-378	Variable, wirewound, 3 ohms, ±10% tol, 25 w	Effective 8-23-63	Ohmite H-3-Si	1
	R11	041-356	Fixed, composition, 20K ohms, ±5% tol, 1/2 w		RC20GF203J	1
D	R11		Deleted	Effective 8-23-63		
	1	18226-01	ARM, Adjusting Collar (R.H.)			1
	2	18227-01	ARM, Adjusting Collar (L.H.)			1
	3	1822-01	ARM, Pinch Roller			1
		--				
		--				
		--				
	20	125694-010	GUIDE, Tape (1/2-inch)			1(-60)
	20	125694-020	GUIDE, Tape (1-inch)			1(-50)
	21	48990-2	GUIDE ASSEMBLY, SHIELD MODIFICATION			1
	21-1	23350-02	Guide, tape			1
	21-2	125374-010	Shield			1
	22	60960-12	KNOB ASSEMBLY, REEL HOLD-DOWN (1/2-inch)			2(-60)
	22	60950-13	KNOB ASSEMBLY, REEL HOLD-DOWN (1-inch)			2(-50)
	22-1	420-010	Ball, nylon, 1/8 in. dia.			3
QD	22-1	420-010	Ball	Effective 8-23-63		1
	22-2					
	22-3					
	22-3					
	22-5					
	22-6					
	22-7	471-733	Screw, machine, #10-32 NC-2A x 1-1/2 in. lg., cross-recessed drive, flat head, steel, cad pl.	MS35193-61		1
QI	22-7	471-733	Screw	Effective 8-23-63		3
	22-8					
	22-9					
	22-10					
	22-11	11541-1	Spacer, 1-inch			1
C	22-11	18233-01	Spacer, 1-inch	Effective 8-23-63		1

Revision Key: A: addition; C: change; D: deletion; PC: part no. change; QD: quantity decrease; QI: quantity increase.

Parts List Explanation

CP-100 RECORDER/REPRODUCER FINAL ASSEMBLY — CATALOG NO. 46000-10, -20 — Sheet 1 of 2

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION	
					10	20
1	46364-2			CASE ASSEMBLY	1	1
2	46372-2			COVER ASSEMBLY	1	1
3	46410-2			FRAME ASSEMBLY	1	1
4	46365-50			TRANSPORT TAPE ASSEMBLY, 1 IN	1	-
5	46365-60			TRANSPORT TAPE ASSEMBLY, 1/2 IN	-	1
6	46370-1			CAPSTAN DRIVE, Inverter, 60 cycle	1	1
7	46380-1			ELECTRONICS, Power Supply	1	1
8	46360-1			PRIMARY POWER SUPPLY	1	1
9	48630-1			POWER CONTROL CASE	1	1
10	46300-1			MASTER BIAS OSCILLATOR	1	1
11	46260-2			BOARD ASSEMBLY, Direct Record Amplifier	A/R	A/R
12	46250-2			BOARD ASSEMBLY, Direct Reproduce Amplifier	A/R	A/R
13.1	46330-10			DIRECT REPRODUCE EQUALIZER, 60 Ips	A/R	A/R
13.2	46330-20			DIRECT REPRODUCE EQUALIZER, 30 Ips	A/R	A/R
13.3	46330-30			DIRECT REPRODUCE EQUALIZER, 15 Ips	A/R	A/R
13.4	46330-40			DIRECT REPRODUCE EQUALIZER, 7-1/2 Ips	A/R	A/R
13.5	46330-50			DIRECT REPRODUCE EQUALIZER, 3-3/4 Ips	A/R	A/R
13.6	46330-60			DIRECT REPRODUCE EQUALIZER, 1-7/8 Ips	A/R	A/R
14	1810217-01			BOARD ASSEMBLY, FM Record Amplifier	A/R	A/R
16	46280-1			FM REPRODUCE AMPLIFIER ASSEMBLY	A/R	A/R
17.1	46390-10			FM REPRODUCE FILTER UNIT, 60 Ips	A/R	A/R
17.2	46390-20			FM REPRODUCE FILTER UNIT, 30 Ips	A/R	A/R
17.3	46390-30			FM REPRODUCE FILTER UNIT, 15 Ips	A/R	A/R
17.4	46390-40			FM REPRODUCE FILTER UNIT, 7-1/2 Ips	A/R	A/R
17.5	46390-50			FM REPRODUCE FILTER UNIT, 3-3/4 Ips	A/R	A/R
17.6	46390-60			FM REPRODUCE FILTER UNIT, 1-7/8 Ips	A/R	A/R
18	1810251-01			BOARD ASSEMBLY, PDM Record	A/R	A/R
19	46420-1			BOARD ASSEMBLY, PDM Reproduce	A/R	A/R
20	46730-3			BOARD ASSEMBLY CONTROL TRACK GENERATOR	A/R	A/R
21	017-003			CRYSTAL PLUG-IN, 18.24KC, Control Track Generator	A/R	A/R
22	017-004			CRYSTAL PLUG-IN, 17.00KC, Control Track Generator	A/R	A/R

CHANGED 15 AUGUST 1964

CP-100 RECORDER/REPRODUCER FINAL ASSEMBLY — CATALOG NO. 46000-10, -20 — Sheet 2 of 2

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION 10	20
23	46421-1			BOARD ASSEMBLY, Blank Plug-in	A/R	A/R
24	48460-1			REMOTE CONTROL ASSEMBLY	A/R	A/R
25	126021-2			RACK MOUNT KIT	A/R	A/R
26	48641-2			ACCESSORY KIT	A/R	A/R
27	1220082-1			GROUND STRAP	1	1
28	471-112	MS35208-14		SCREW, Machine, Pan Head, #4-40 NC-2A x 3/8 Lg., Sst., Passivated	8	8
29	471-140	MS35217-57		SCREW, Machine, Pan Head, #10-32 NF-2A x 5/8 Lg., Sst., Passivated	16	16
30	501-017	MS15795-308		WASHER, Flat, #10, Sst., Passivated	16	16
31	471-064	MS35208-16		SCREW, Machine, Pan Head, #4-40 NC-2A, x 1/4 Lg., Steel, Cad. Plt.	1	1
32	501-008	MS15795-204		WASHER, Flat, #4, Steel, Cad. Plt., .040 Thk.	1	1
33	493-005			NUT, Hex, Self Locking, #4-40 NC-3B, Stl., Cad. Plt.	1	1
34	503-047	Birnbach No. 6957		WASHER, Flat, 9/32 ID, Nylon	2	2
35	471-142			SCREW, Machine, Pan Head, #10-32 NF-2A x 7/8 Lg., Sst., Passivated	6	6
36	471-357	MS35193-56		SCREW, Machine, 82° C'sk., Head, #10-32 NF-2A x 5/8 Lg., Stl. Cad. Plt.	10	10
37	501-014			WASHER, #4, Sst.	8	8
38	1222058-10			SHIM	A/R	A/R

CHANGED 15 AUGUST 1964

PARTS LIST FOR:

CP-100 DIRECT REPRODUCE AMPLIFIER CARD CATALOG NO. 46250-20

	REF. NO.	AMPEX PART NO.	DESCRIPTION			NO/ ASSY.
			CAPACITORS			
	C1	037-065	Fixed, tantalum, 4.7 μf, ±20% tol, 10V dc		Sprague 150D475X0010A2	1
	C2	037-028	Fixed, tantalum, 22 μf, ±20% tol, 15V dc		Sprague 150D226X0015B2	1
	C3	037-072	Fixed, tantalum, 330 μf, ±20% tol, 6V dc		Sprague 150D337X0006S2	1
	C4	034-181	Fixed, mica, 47 pf, ±5% tol, 500V dc		Elmenco DM15E470J	1
	C5	037-028	Same as C2			1
	C6	034-215	Fixed, mica, 10 pf, ±5% tol, 500V dc		Elmenco DM15C100J	1
	C7	037-044	Fixed, tantalum 100 μf, ±20% tol, 15V dc		Texas Instruments SCM107DPO15A4	1
	C8	034-181	Same as C4			1
	C9	037-044	Same as C7			1
	C10	037-058	Fixed, tantalum, 1 μf, ±20% tol, 35V dc		Sprague 150D105X0035A2	1
	C11	034-181	Same as C4			1
	C12		Not used			
	C13	034-328	Fixed, mica, 100 pf, ±5% tol, 500V dc		Elmenco DM19F101J	1
	C14	037-124	Fixed, tantalum, 35 μf, ±20% tol, 25V dc		Texas Instruments SYM356EPO25C4	1
	C15	034-328	Same as C13			1
	C16	037-072	Same as C3			1
	C17	033-061	Fixed, metallized, 0.01 μf, ±3% tol, 200V dc		Electron Products D2-103C	1
	C18	033-056	Fixed, metallized, 0.22 μf, ±10% tol, 200V dc		Electron Products D2-224E	1
	C19	033-056	Same as C18			1
A	C20	034-226	Fixed, mica, 150 pf, ±5% tol, 500V dc	Effective 11-27-62	Elmenco DM15F151F	1
			INDUCTORS			
	L1	125550-101	Variable, 126 μh, ±20% μh			1
			TRANSISTORS			
	Q1	014-030	Germanium, NPN		General Instrument 2N446A	1
	Q2	014-032	Germanium, PNP		General Instrument 2N603	1
	Q3	014-030	Same as Q1			1
	Q4	014-032	Same as Q2			1
	Q5	014-032	Same as Q2			1
	Q6	014-032	Same as Q2			1
	Q7	014-030	Same as Q1			1
	Q8	014-032	Same as Q2			1
	Q9	014-030	Same as Q1			1
	Q10	014-029	Germanium, PNP		Tungsol 2N414	1
	Q11	014-029	Same as Q10			1
	Q12	014-030	Same as Q1			1
			RESISTORS			
	R1	041-408	Fixed, composition, 10K ohms, ±5% tol, 1/4 w		RCO7GF103J	1
	R2	041-408	Same as R1			1
	R3	041-406	Fixed, composition, 22K ohms, ±5% tol, 1/4 w		RCO7GF223J	1
	R4	041-412	Fixed, composition, 4700 ohms, ±5% tol, 1/4 w		RCO7GF472J	1
	R5	041-409	Fixed, composition, 15K ohms, ±5% tol, 1/4 w		RCO7GF153J	1
	R6	041-408	Same as R1			1
	R7	041-414	Fixed, composition, 2200 ohms, ±5% tol, 1/4 w		RCO7GF222J	1
	R8	041-412	Same as R4			1
	R9	041-406	Same as R3			1
	R10	041-412	Same as R4			1
	R11	042-329	Fixed, deposited film, 4640 ohms, ±1% tol, 1/4 w		Key Resistor KV-10	1
	R12	041-412	Same as R4			1
	R13	042-328	Fixed, deposited film, 10K ohms, ±1% tol, 1/10 w		Key Resistor EM2	1
	R14	044-235	Variable, carbon, linear, 2500 ohms, ±20% tol, 1/4 w		Allen Bradley F-FP252M	1
	R15	041-518	Fixed, composition, 33K ohms, ±5% tol, 1/4 w		RCO7GF333J	1
	R16	041-413	Fixed, composition, 6800 ohms, ±5% tol, 1/4 w		RCO7GF682J	1
	R17	041-408	Same as R1			1
	R18	041-409	Same as R5			1
	R19	041-412	Same as R4			1
	R20	041-408	Same as R1			1
	R21	041-412	Same as R4			1
	R22	041-426	Fixed, composition, 68 ohms, ±5% tol, 1/4 w		RCO7GF680J	1
	R23	041-408	Same as R1			1
	R24	041-428	Fixed, composition, 470 ohms, ±5% tol, 1/4 w		RCO7GF471J	1
	R25	041-414	Same as R7			1
	R26	041-412	Safe as R4			1
	R27	041-429	Fixed, composition, 680 ohms, ±5% tol, 1/4 w		RCO7GF681J	1
	R28	041-430	Fixed, composition, 1500 ohms, ±5% tol, 1/4 w		RCO7GF152J	1
	R29	044-290	Variable, carbon, linear, 10K ohms, ±20% tol, 1/4 w		Allen Bradley RP103M	1
	R30	041-412	Same as R4			1
	R31	041-429	Same as R27			1
	R32	041-411	Fixed, composition, 47K ohms, ±5% tol, 1/4 w		RCO7GF473J	1
	R33	041-408	Same as R1			1
	R34	041-407	Fixed, composition, 3300 ohms, ±5% tol, 1/4 w		RCO7GF332J	1
	R35		Not Used			
	R36	041-430	Same as R28			1
	R37	041-428	Same as R24			1
	R38	041-406	Same as R3			1
	R39	041-425	Fixed, composition, 47 ohms, ±5% tol, 1/4 w		RCO7GF470J	1
	R40	041-425	Same as R39			1
	R41	041-429	Same as R27			1
	R42	041-408	Same as R1			1
	R43	041-430	Same as R28			1
	R44	041-427	Fixed, composition, 330 ohms, ±5% tol, 1/4 w		RCO7GF331J	1
	R45	041-433	Fixed, composition, 27 ohms, ±5% tol, 1/2 w		RC20GF270J	1
	R46	041-002	Fixed, composition, 10 ohms, ±5% tol, 1/2 w		RC20GF100J	1
	R47	041-407	Same as R34			1
	R48	041-410	Fixed, composition, 1000 ohms, ±5% tol, 1/4 w		RCO7GF102J	1
			TEST POINTS			
	TP1	148-039	Black, 0.655 in. lg. x 0.286 in. dia., 0.218 in. dia. mtg. hole		Raytheon 276-1570G6	1
	TP2	148-038	Red. 0.655 in. lg. x 0.286 in. dia., 0.218 in. dia. mtg. hole		Raytheon 276-1570G4	1
	1	46251-1	CIRCUIT BOARD, Printed Wiring			1
	2	46417-1	INSULATOR, Shield			1
	3	46336-1	PANEL, Detail			1

PARTS LIST FOR:

CP-100 DIRECT REPRODUCE AMPLIFIER CARD CATALOG NO. 46250-20

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
4	471-055	SCREW, Machine, slotted pan head, #2-56 x 5/16 in. lg., steel, cad pl	MS35225-4	2
5	471-838	SCREW, Machine, slotted pan head, #2-56 x 3/16 in. lg., steel, cad pl	MS35225-2	3
6	46325-1	SHIELD, Electrostatic		1
7	150-103	SOCKET, Transistor Mounting	Elco 3303	12
8	502-001	WASHER, Lock, spring, #2, steel, cad pl	MS35338-39	5

Revision Key: A: addition

PARTS LIST FOR:

CP-100 DIRECT RECORD AMPLIFIER CARD — CATALOG NO. 46260-21

	REF. NO.	AMPEX PART NO.	DESCRIPTION			NO/ ASSY.
			CAPACITORS			
	C1	031-205	Fixed, electrolytic, 5 μf, -10 to +100% tol, 500v dc		Sprague 30D193A1	1
	C2	034-253	Fixed, mica, 330 pf, ±1% tol, 500v dc		Elmenco DM15F331F	1
	C3	037-086	Fixed, tantalum, 100 μf, ±20% tol, 6v dc		US Semcor TS2K-6-107	1
	C4	034-222	Fixed, mica, 100 pf, ±1% tol, 500v dc		Elmenco DM15F101F	1
	C5	031-205	Same as C1			1
	C6	034-222	Same as C4			1
	C7	031-205	Same as C1			1
	C8	037-080	Fixed, tantalum, 10 μf, ±20% tol, 25v dc		US Semcor TS2K-25-106	1
	C9	033-052	Fixed, tubular, 0.001 μf, ±5% tol, 200v dc		Electron DI-2-102D	1
	C10	034-180	Fixed, mica, 39 μf, ±5% tol, 500v dc		Elmenco DM15E390F	1
	C11	033-053	Fixed, tubular, 2200 pf, ±10% tol, 200v dc		Electron DI-2-222E	1
	C12	037-187	Fixed, tantalum, 120 μf, ±10% tol, 20v dc		Texas Instruments SCM127HP020A2	1
	C13	033-055	Fixed, tubular, 0.1 μf, ±20% tol, 200v dc		Electron DI-2-104	1
	C14	037-187	Same as C12			1
	C15	033-055	Same as C13			1
	C16	033-055	Same as C13			1
	C17	033-055	Same as C13			1
	C18	033-055	Same as C13			1
	C19	033-055	Same as C13			1
	C20	033-055	Same as C13			1
			INDUCTORS			
	L1	91014-30	Variable, 25.3 μh, +4 μh			1
	L2	91014-20	Variable, 540 μh, +80 μh			1
	L3	91014-1	Variable, 12.6 μh, +2 μh			1
	L4	540-003	Fixed, 220 μh, ±8% tol		Essex WEE-220	1
			TRANSISTORS			
	Q1	014-029	Germanium, PNP		General Instrument 2N414	1
	Q2	014-029	Same as Q1			1
	Q3	014-030	Germanium, NPN		General Instrument 2N446A	1
	Q4	014-029	Same as Q1			1
	Q5	014-031	Germanium, PNP ;(drift type)		General Instrument 2N1064	1
	Q6	014-031	Same as Q5			1
	Q7	014-031	Same as Q1			1
			RESISTORS			
	R1	044-236	Variable, carbon, linear, 25K ohms, ±20% tol, 1/4 w		Allen Bradley RP253M	1
	R2	041-407	Fixed, composition, 3300 ohms, ±5% tol, 1/4 w		RC07GF332J	1
	R3	042-327	Fixed, deposited film, 1500 ohms, ±1% tol, 1/10 w		Key Resistor, type EM2	1
	R4	042-236	Fixed, deposited film, 1900 ohms, ±1% tol, 1/10 w		Key Resistor, type EM2	1
	R5	041-412	Fixed, composition, 4700 ohms, ±5% tol, 1/4 w		RC07GF472J	1
	R6	041-413	Fixed, composition, 6800 ohms, ±5% tol, 1/4 w		RC07GF682J	1
	R7	041-414	Fixed, composition, 2200 ohms, ±5% tol, 1/4 w		RC07GF222J	1
	R8	041-406	Fixed, composition, 22K ohms, ±5% tol, 1/4 w		RC07GF223J	1
	R9	041-414	Same as R7			1
	R10	041-415	Fixed, composition, 68K ohms, ±5% tol, 1/4 w		RC07GF683J	1
	R11	041-409	Fixed, composition, 15K ohms, ±5% tol, 1/4 w		RC07GF153J	1
	R12	041-395	Fixed, composition, 1000 ohms, ±5% tol, 1/4w		RC07GF102J	
	R13	041-409	Same as R11			1
	R14	041-396	Fixed, composition, 220 ohms, ±5% tol, 1/4 w		RC07GF221J	1
	R15	041-396	Same as R14			1
	R16	044-225	Variable, carbon, linear, 500 ohms, ±10% tol, 1/4 w		Allen Bradley RP501U	1
	R17	041-733	Fixed, composition, 56 ohms, ±5% tol, 1/4 w		RC07GF560J	1
	R18	042-330	Fixed, deposited film, 10 ohms, ±1% tol, 1/8 w		Texas Instruments CDH1/8M	1
	R19	041-421	Fixed, composition, 22 ohms, ±5% tol, 1/4 w		RC07GF220J	1
	R20	041-421	Same as R19			1
	R21	041-008	Fixed, composition, 1500 ohms, ±5% tol, 1/2 w		RC20GF152J	1
	R22	041-417	Fixed, composition, 390 ohms, ±5% tol, 1/4 w		RC07GF391J	1
	R23	041-407	Same as R2			1
	R24	041-395	Same as R12			1
	R25	041-530	Fixed, composition, 15 ohms, ±5% tol, 1/4 w		RC07GF150J	1
	R26	041-530	Same as R25			1
			TRANSFORMERS			
	T1	46311-1	Interstage			1
	T2	46301-1	Bias Input			1
			TEST POINTS			
	TP1	148-042	White, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole		Raytheon 276-1570G9	1
	TP2	148-038	Red, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole		Raytheon 276-1570G4	1
	TP3	148-039	Black, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole		Raytheon 276-1570G6	1
	1	126090-010	CIRCUIT BOARD, Printed wiring			1
	2	46417-1	INSULATOR, Shield			1
	3	46308-1	PANEL, Direct record			1
	4	471-838	SCREW, Machine, slotted pan head, #2-56 NC-2A x 3/16 in. lg, steel, cad pl		MS35225-2	3
	5	471-055	SCREW, Machine, slotted pan head, #2-56 NC-2A x 5/16 in. lg, steel, cad pl		MS35225-4	2
	6	46325-1	SHIELD			1
	7	150-103	SOCKET, Transistor mounting		Elco 3303	7
	8	502-023	WASHER, Lock, int. tooth, #2, steel, cad pl		MS35333-35	5
C	8	502-001	WASHER, Lock, spring, #2, steel, cad pl	Effective 4-18-63	MS35338-39	5

Revision Key: C: Change

FM REPRODUCE AMPLIFIER ASSEMBLY				CATALOG NO. 46280-11										Sheet 1 of 3
ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION									
					11									
1	46269-1			PRINTED WIRING BOARD	1									
2	46373-1			PANEL, Detail	1									
3	46325-1			SHIELD, Electrostatic	1									
4	46443-1		CR13,14	DIODE ASSEMBLY	1									
5	46417-1			INSULATOR, Shield	1									
6	49260-10			PLATE, Serial, Specification	1									
7	037-107			CAPACITOR, Tantalum, 2.2μf, ±20%, 35v	1									
8	034-238			CAPACITOR, Mica, 47 pf, ±10%, 500v	3									
9	034-240			CAPACITOR, Mica, 220 pf, ±10%, 500v	1									
10	033-053	Elect. Prod. #D1-2-222-E		CAPACITOR, Mylar, 0.0022μf, ±10%, 250v	1									
11	035-568			CAPACITOR, Mylar, 0.0068μf, ±10%, 100v	1									
12	037-065			CAPACITOR, Tantalum, 4.7μf, ±20%, 10v	2									
13	037-061			CAPACITOR, Tantalum, 6.3μf, ±20%, 6v	1									
14	037-024			CAPACITOR, Tantalum, 2.2μf, ±20%, 20v	4									
15	037-125			CAPACITOR, Tantalum, 4.7μf, ±20%, 15v	3									
16	037-028			CAPACITOR, Tantalum, 22μf, ±20%, 15v	4									
17	037-127			CAPACITOR, Tantalum, 33μf, ±20%, 10v	3									
18	041-394			RESISTOR, Fixed, Carbon, 100K, ±5%, 1/4w	1									
19	034-177	Elmenco: DM-15F101J		CAPACITOR, Mica, 100 pf, ±5%, 500v	1									
20	041-504			RESISTOR, Fixed, Carbon, 510 ohms, ±5%, 1/4w	1									
21	041-559	MIL-R-11: RC07GF121J		RESISTOR, Fixed, Carbon, 120 ohms, ±5% 1/4w	3									
22	041-429			RESISTOR, Fixed, Carbon, 680 ohms, ±5%, 1/4w	1									
23	041-505			RESISTOR, Fixed, Carbon, 620 ohms, ±5%, 1/4w	3									
24	041-395			RESISTOR, Fixed, Carbon 1000 ohms, ±5%, 1/4w	4									
25	041-430			RESISTOR, Fixed, Carbon, 1500 ohms, ±5%, 1/4w	3									
26	041-531			RESISTOR, Fixed, Carbon, 750 ohms, ±5%, 1/4w	1									
27	041-560	MIL-R-11: RC07GF202J		RESISTOR, Fixed, Carbon, 2000 ohms, ±5%, 1/4w	2									
28	041-407			RESISTOR, Fixed, Carbon, 3300 ohms, ±5%, 1/4w	2									
29	041-532			RESISTOR, Fixed, Carbon, 910 ohms, ±5%, 1/4w	2									

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION 11
30	041-412			RESISTOR, Fixed, Carbon, 4700 ohms, ±5%, 1/4w	3
31	041-538			RESISTOR, Fixed, Carbon, 6200 ohms, ±5%, 1/4w	1
32	041-408			RESISTOR, Fixed, Carbon, 10K ohms, ±5%, 1/4w	7
33	041-482			RESISTOR, Fixed, Carbon, 12K ohms, ±5%, 1/4w	1
34	041-409			RESISTOR, Fixed, Carbon, 15K ohms, ±5%, 1/4w	2
35	041-406			RESISTOR, Fixed, Carbon, 22K ohms, ±5%, 1/4w	1
36	041-562	MIL-R-11: RC07GF433J		RESISTOR, Fixed, Carbon, 43K ohms, ±5%, 1/4w	1
37	041-436			RESISTOR, Fixed, Carbon, 18K ohms, ±5%, 1/4w	1
38	041-411			RESISTOR, Fixed, Carbon, 47K ohms, ±5%, 1/4w	1
39	041-563	MIL-R-11: RC07GF244J		RESISTOR, Fixed, Carbon, 240K ohms, ±5%, 1/4w	1
40	041-561	MIL-R-11: RC07GF512J		RESISTOR, Fixed, Carbon, 5100 ohms, ±5%, 1/4w	1
41	042-336			RESISTOR, Carbon Film, 56.2K ohms, ±1%, 1/8w (No Sub.) (Key Res. Type E2)	1
42	042-284			RESISTOR, Carbon Film, 15K ohms, ±1%, 1/8w	1
43	042-339			RESISTOR, Carbon Film, 31.6K ohms, 1%, 1/8w	1
44	043-497			RESISTOR, Wirewound, 1000 ohms, ±1%, 1/10w	1
45	043-500			RESISTOR, Wirewound, 7.5K ohms, ±1%, 1/10w, (Kelvin Type EP-01) (No Sub.)	1
46	044-209			RESISTOR, Variable, 1000 ohms, ±10%	2
47	046-011	TM 1/8		SENSISTOR, 1000 ohms, ±10%, 1/8w	2
48	46442-1			TRANSFORMER	1
49	013-203	HD6161 (Hughes)	CR15	STABISTOR, SI,	1
50	013-200	1N116 (Hughes)	CR7,8, 10,12,19	DIODE, GE, Switching	5
52	013-201	1N914	CR1 thru 6, CR9, CR18	DIODE, SI, Switching	8
53	013-202	1N825 (Motorola)	CR16,17	DIODE, Zener, 6.2v, ±5%	2
54	014-029	2N414	Q1,3,5	TRANSISTOR	3
55	014-216	2N2189	Q2,4,6	TRANSISTOR	3

FM REPRODUCE AMPLIFIER ASSEMBLY				CATALOG NO. 46280-11		Sheet 3 of 3
ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION	
					11	
56	014-137	2N708 (Fairchild)	Q10, 11	TRANSISTOR	2	
57	014-245	2N861 (Philco)	Q14, 15	TRANSISTOR	2	
58	280-030			TRANSISTOR, Spacer	3	
59	014-210	2N2218 (Motorola)	Q13	TRANSISTOR	1	
60	014-109	2N1499A (Philco)	Q7 thru Q9, Q12	TRANSISTOR	4	
61	148-042	Raytheon #276-1570G9		JACK TEST, White	1	
62	148-039	Raytheon #276-1570G6		JACK TEST, Black	1	
63	148-038	Raytheon #276-1570G4		JACK TEST, Red	1	
64	460-069	(Chicago Rivet)		RIVET, Oval Head, .060 Dia. x 5/16 Lg.,	2	
65	471-055			SCREW, Pan Head, Slotted, #2-56 x 5/16 Lg.	2	
66	471-838			SCREW, Pan Head, Slotted, #2-56 x 3/16 Lg.	3	
67	502-001			WASHER, Lock #2	5	
69	600-036			TUBING, #20, Teflon Clear, Ins. and Wire Inc.	A/R	
70	169-116	Elco Corp. #CS-6-C-200-5208		CONTACT STRIP	1	
71	150-103	Elco Corp. #3303		SOCKET, Insulator, Transistor	9	
72	087-136	Sherwin Williams: #V61V25		VARNISH, Insulator, Elect. Silicon, See Note 5	A/R	
73	030-190			CAPACITOR, Mica, 1 pf, 500v	1	
74	280-047			TRANSISTOR, Spacer	7	

CHANGED 15 AUGUST 1964

PARTS LIST FOR:	CP-100 REPRODUCE PREAMPLIFIER	CATALOG NO. 46290-30 (4 preamplifiers on one card) CATALOG NO. 46290-40 (3 preamplifiers on one card)	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
		CAPACITORS	
C101	037-085	Fixed, tantalum, 47 μf, ±20% tol, 6v dc	Sprague 150D476X0006B2	1
C102	033-054	Fixed, tubular, 0.01 μf, ±20% tol, 200v dc	Electron DI-2-103	1
C103	037-042	Fixed, tantalum, 330 μf, ±20% tol, 6v dc	Sprague 250D337X0006S2	1
C104	034-206	Fixed, mica, 18 pf, ±5% tol, 500v dc	Elmenco DM15C180J	1
C201	037-085	Same as C101		1
C202	033-054	Same as C102		1
C203	037-042	Same as C103		1
C204	034-206	Same as C104		1
C301	037-085	Same as C101		1
C302	033-054	Same as C102		1
C303	037-042	Same as C103		1
C304	034-206	Same as C104		1
C401	037-085	Same as C101		1(-30)
C402	033-054	Same as C102		1(-30)
C403	037-042	Same as C103		1(-30)
C404	034-206	Same as C104		1(-30)
		TRANSISTORS	
Q101	91021	Germanium, PNP (selected)	General Instruments 2N522A	1
Q102	014-216	Germanium, PNP	Texas Instruments 2N2189	1
Q103	014-206	Same as Q102		1
Q201	91021	Same as Q101		1
Q202	014-216	Same as Q102		1
Q203	014-216	Same as Q102		1
Q301	91021	Same as Q101		1
Q302	014-216	Same as Q102		1
Q303	014-216	Same as Q102		1
Q401	91021	Same as Q101		1(-30)
Q402	014-216	Same as Q102		1(-30)
Q403	014-216	Same as Q102		1(-30)
		RESISTORS	
R101	041-409	Fixed, composition, 15K ohms, ±5% tol, 1/4 w	RC07GF153J	1
R102	041-406	Fixed, composition, 22K ohms, ±5% tol, 1/4 w	RC07GF223J	1
R103	041-412	Fixed, composition, 4700 ohms, ±5% tol, 1/4 w	RC07GF472J	1
R104	041-415	Fixed, composition, 68K ohms, ±5% tol, 1/4 w	RC07GF683J	1
R105	041-414	Fixed, composition, 2200 ohms, ±5% tol, 1/4 w	RC07GF222J	1
R106	041-406	Same as R102		1
R107	041-425	Fixed, composition, 47 ohms, ±5% tol, 1/4 w	RC07GF470J	1
R108	044-230	Variable, wirewound, 200 ohms, ±10% tol, 1/4 w, linear	Bourns 200P-p-201	1
R109	041-408	Fixed, composition, 10K ohms, ±5% tol, 1/4 w	RC07GF103J	1
R110	041-408	Same as R109		1
R111	041-570	Fixed, composition, 2400 ohms, ±5% tol, 1/4 w	RC07GF242J	1
R201	041-409	Same as R101		1
R202	041-406	Same as R102		1
R203	041-412	Same as R103		1
R204	041-415	Same as R104		1
R205	041-414	Same as R105		1
R206	041-406	Same as R102		1
R207	041-425	Same as R107		1
R208	044-230	Same as R108		1
R209	041-408	Same as R109		1
R210	041-408	Same as R109		1
R211	041-570	Same as R111		1
R301	041-409	Same as R101		1
R302	041-406	Same as R102		1
R303	041-412	Same as R103		1
R304	041-415	Same as R104		1
R305	041-414	Same as R105		1
R306	041-406	Same as R102		1
R307	041-425	Same as R107		1
R308	044-230	Same as R108		1
R309	041-408	Same as R109		1
R310	041-408	Same as R109		1
R311	041-570	Same as R111		1
R401	041-409	Same as R101		1(-30)
R402	041-406	Same as R102		1(-30)
R403	041-412	Same as R103		1(-30)
R404	041-415	Same as R104		1(-30)
R405	041-414	Same as R105		1(-30)
R406	041-406	Same as R102		1(-30)
R407	041-425	Same as R107		1(-30)
R408	044-230	Same as R108		1(-30)
R409	041-408	Same as R109		1(-30)
R410	041-408	Same as R109		1(-30)
R411	041-570	Same as R111		1(-30)
		TEST POINTS	
TP101	148-027	Red	Ucinite 119437B	1
TP102	148-052	Black	Ucinite 119437C	1
TP201	148-027	Same as TP101		1
TP202	148-052	Same as TP102		1
TP301	148-027	Same as TP101		1
TP302	148-052	Same as TP102		1
TP401	148-027	Same as TP101		1(-30)
TP402	148-052	Same as TP102		1(-30)
1	126230-010	CIRCUIT BOARD, Printed Wiring		1
2	435-041	CLIP, Retaining, transistor	Augat 6027-2C	8(-30)
2	435-041	CLIP, Retaining, transistor	Augat 6026-2C	6(-30)

PARTS LIST FOR:	CP-100 REPRODUCE PREAMPLIFIER	CATALOG NO. 46290-30 (4 preamplifiers on one card) CATALOG NO. 46290-40 (3 preamplifiers on one card)	

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
3	46426-2	INSULATOR, Preamplifier		1
4	471-103	SCREW, Machine, slotted pan head, #2-56 NC-2A x 3/16 in. lg, steel, cad pl	MS3533-2	3
5	280-030	SPACER, Transistor	Transipad 10012	4(-30)
5	280-030	SPACER, Transistor	Transipad 10012	3(-40)
6	502-023	WASHER, Lock, int. tooth, #2, steel, cad pl	MS35333-35	3
7	503-040	WASHER, Non-metallic, nylon, 3/16 in. od x 0.090 in. id x 0.020 in. thk	Birnbach 6592	3

PARTS LIST FOR:

CP-100 MASTER BIAS OSCILLATOR — CATALOG NO. 46300-10

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	030-095	Fixed, ceramic, disc, 0.1 μf, ±20% tol, 25v dc	Sprague 5C7	1
C2	030-095	Same as C1		1
C3	037-076	Fixed, tantalum, 22 μf, ±20% tol, 20v dc	U.S Semcor TS3K-20-226	1
C4	030-098	Fixed, ceramic, disc, 0.22 μf, ±20% tol, 25v dc	Sprague 5C9	1
C5	030-098	Same as C4		1
C6	030-098	Same as C4		1
C7	030-098	Same as C4		1
C8	030-095	Same as C1		1
		INDUCTOR		
L1	540-008	Fixed, 680 μh, ±5% tol	Essex WEE-680	1
		TRANSISTORS		
Q1 thru Q5	014-031	Germanium, PNP	General Instrument 2N1065	5
		RESISTORS		
R1	041-344	Fixed, composition, 390 ohms, ±5% tol, 1/2 watt	RC20GF391J	1
R2	041-013	Fixed, composition, 4700 ohms, ±5% tol, 1/2 watt	RC20GF472J	1
R3	041-343	Fixed, composition, 680 ohms, ±5% tol, 1/2 watt	RC20GF681J	1
R4	041-239	Fixed, composition, 2200 ohms, ±5% tol, 1/2 watt	RC20GF222J	1
R5	041-239	Same as R4		1
R6	041-239	Same as R4		1
R7	041-239	Same as R4		1
R8	041-008	Fixed, composition, 1500 ohms, ±5% tol, 1/2 watt	RC20GF152J	1
R9	041-384	Fixed, composition, 68 ohms, ±5% tol, 1/2 watt	RC20GF680J	1
R10	041-384	Same as R9		1
R11	041-008	Same as R8		1
R12	041-245	Fixed, composition, 1000 ohms, ±5% tol, 1/2 watt	RC20GF102J	1
R13	041-245	Same as R12		1
		TRANSFORMERS		
T1	46312-1	Input, bias		1
T2	46315-1	Line Output, bias		1
		TEST POINTS		
TP1	148-042	White, 0.655 in. lg x 0.286 in. dia, 0.218 in. mtg hole	Raytheon 276-1570G9	1
TP2	148-042	Same as TP1		1
		CRYSTAL		
Y1	017-002	Quartz, 1.0 mc, ±0.005% tol	Midland ML-6-CR19/4	1
1	46314-1	BRACKET		1
2	46298-1	CHASSIS, Subassembly		1
3	46310-10	CIRCUIT BOARD ASSEMBLY, Oscillator (includes components mounted on item 4)		1
4	46321-1	CIRCUIT BOARD, Printed Wiring		1
5	147-136	CONNECTOR, Male, 7 contacts	Continental C7-20P-VS	1
6	46299-1	COVER, Subassembly		1
7	471-061	SCREW, Machine, #4-40 NC-2A x 5/16 in lg, cross-recessed drive, pan hd, steel, cad pl	MS35208-13	2
8	150-087	SOCKET, Crystal	Augat 8000-AG4	1
9	150-103	SOCKET, Transistor mounting, insulator	Elco 3303	5
10	502-024	WASHER, Lock, #4, internal tooth, steel, cad pl	MS35333-35	2

PARTS LIST FOR:

CP-100 DIRECT REPRODUCE EQUALIZER, 60 IPS — CATALOG NO. 46330-10

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	034-222	Fixed, mica, 100 pf, ±5% tol, 500v dc	Elmenco DM15F101F	1
C2	034-214	Fixed, mica, 470 pf, ±5% tol, 300v dc	Elmenco DM15E471J	1
		INDUCTORS		
L1	91035-40	Variable, 2.5 mh		1
		RESISTORS		
R1	042-237	Fixed, deposited film, 1140 ohms, ±1% tol, 1/2 w	Texas Instruments CD1/2PR	1
R2	041-415	Fixed, composition, 68K ohms, ±5% tol, 1/4 w	RC07GF683J	1
R3	044-245	Variable, carbon, linear, 50K ohms, ±20% tol, 1/4 w	Allen Bradley RP503M	1
1	125556-010	BRACKET, Inductor Mounting		1
2	46331-1	CIRCUIT BOARD, Printed Wiring		1
3	46532-1	INDICATOR, Equalizer Speed		1

46330C

PARTS LIST FOR:

CP-100 DIRECT REPRODUCE EQUALIZER, 30 IPS — CATALOG NO. 46330-20

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	034-219	Fixed, mica, 120 pf, ±1% tol, 500v dc	Elmenco DM15F121F	1
C2	034-303	Fixed, mica, 910 pf, ±5% tol, 500v dc	Elmenco DM19F911J	1
		INDUCTORS		
L1	91035-30	Variable, 10 mh		1
		RESISTORS		
R1	042-224	Fixed, deposited film, 1910 ohms, ±1% tol, 1/2 w	Texas Instruments CD1/2PR	1
R2	041-431	Fixed, composition, 150K ohms, ±5% tol, 1/4 w	RC07GF154J	1
R3	044-243	Variable, carbon, linear, 100K ohms, ±20% tol, 1/4 w	Allen Bradley RP104M	1
1	125556-010	BRACKET, Inductor Mounting		1
2	46331-1	CIRCUIT BOARD, Printed Wiring		1
3	46532-2	INDICATOR, Equalizer Speed		1

PARTS LIST FOR:

CP-100 DIRECT REPRODUCE EQUALIZER, 15 IPS — CATALOG NO. 46330-30

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	034-224	Fixed, mica, 160 pf, ±1% tol, 500v dc	Elmenco DM15F161F	1
C2	034-216	Fixed, mica, 1800 pf, ±5% tol, 500v dc	Elmenco DM19F182J	1
		INDUCTORS		
L1	91035-21	Variable, 35 mh		1
		RESISTORS		
R1	042-241	Fixed, deposited film, 3600 ohms, ±1% tol, 1/2 w	Texas Instruments CD1/2PR	1
R2	041-432	Fixed, composition, 220K ohms, ±5% tol, 1/4 w	RC07GF224J	1
R3	044-244	Variable, carbon, linear, 250K ohms, ±20% tol, 1/4 w	Allen Bradley RP245M	1
1	125556-010	BRACKET, Inductor Mounting		1
2	46331-1	CIRCUIT BOARD, Printed Wiring		1
3	46532-3	INDICATOR, Equalizer Speed		1

46330C

PARTS LIST FOR:

CP-100 DIRECT REPRODUCE EQUALIZER, 7-1/2 IPS — CATALOG NO. 46330-40

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	034-225	Fixed, mica, 220 pf, ±1% tol, 500v dc	Elmenco DM15F221F	1
C2	034-218	Fixed, mica, 3900 pf, ±5% tol, 500v dc	Elmenco DM20E392J	1
		INDUCTORS		
L1	91035-10	Variable, 100 mh		1
		RESISTORS		
R1	042-239	Fixed, deposited film, 6400 ohms, ±1% tol, 1/2 w	Texas Instruments CD1/2PR	1
R2	041-469	Fixed, composition, 330K ohms, ±5% tol, 1/4 w	RC07GF334J	1
R3	044-244	Variable, carbon, linear, 250K ohms, ±20% tol, 1/4 w	Allen Bradley RP245M	1
1	125556-010	BRACKET, Inductor Mounting		1
2	46331-1	CIRCUIT BOARD, Printed Wiring		1
3	46532-4	INDICATOR, Equalizer Speed		1

PARTS LIST FOR:

CP-100 DIRECT REPRODUCE EQUALIZER, 3-3/4 IPS — CATALOG NO. 46330-50

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	034-329	Fixed, mica, 1000 pf, ±1% tol, 500v dc	Elmenco DM19F102F	1
C2	033-060	Fixed, tubular, 0.01 μf, ±5% tol, 200v dc	Electron DI-2-103D	1
C3	033-060	Same as C2		1
C4	033-059	Fixed, tubular, 0.047 μf, ±5% tol, 200v dc	Electron DI-2-473D	1
C5	034-208	Fixed, mica, 30 pf, ±5% tol, 500v dc	Elmenco DM15E300J	1
		INDUCTORS		
L1	540-047	Fixed, 100 mh	Data Filter Corp DF050-100PRVL	1
		RESISTORS		
R1	042-331	Fixed, deposited film, 16,900 ohms, ±1% tol, 1/4 w	Texas Instruments CD1/4R	1
R2	041-431	Fixed, composition, 150K ohms, ±5% tol, 1/4 w	RC07GF154J	1
R3	044-244	Variable, carbon, linear, 250K ohms, ±20% tol, 1/4 w	Allen Bradley RP245M	1
R4	044-236	Variable, carbon, linear, 25K ohms, ±5% tol, 1/4 w	Allen Bradley R-RP253M	1
R5	041-395	Fixed, composition, 1000 ohms, ±5% tol, 1/4 w	RC07GF102J	1
1	46331-2	CIRCUIT BOARD, Printed Wiring		1
2	46532-5	INDICATOR, Equalizer Speed		1
3	492-007	NUT, Plain, hex, #2-56 NC-2B, steel, cad pl	MS35649-22	2
4	471-058	SCREW, Machine, #2-56 NC-2A x 1/2 in. lg, slotted pan head, steel, cad pl	MS35225-7	2
5	501-007	WASHER, Flat, #2, steel, cad pl	MS15795-202	2
6	502-023	WASHER, Lock, int. tooth, #2, steel, cad pl	MS35333-35	2

46330C

PARTS LIST FOR:

CP-100 DIRECT REPRODUCE EQUALIZER, 1-7/8 IPS — CATALOG NO. 46330-60

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	034-330	Fixed, mica, 750 pf, ±1% tol, 500v dc	Elmenco DM19F101J	1
C2	033-060	Fixed, tubular, 0.01 μf, ±5% tol, 200v dc	Electron DI-2-103D	1
C3	033-060	Same as C2		1
C4	033-058	Fixed, tubular, 0.022 μf, ±5% tol, 200v dc	Electron DI-2-223D	1
C5	034-181	Fixed, mica, 47 pf, ±5% tol, 500v dc	Elmenco DM15E470J	1
		INDUCTORS		
L1	540-046	Fixed, 500 mh	Data Filter Corp DF050-500PRVL	1
		RESISTORS		
R1	042-332	Fixed, deposited film, 24,900 ohms, ±5% tol, 1/4 w	Texas Instruments CD1/4R	1
R2	041-543	Fixed, composition, 82K ohms, ±5% tol, 1/4 w	RC07GF823J	1
R3	044-244	Variable, carbon, linear, 250K ohms, ±20% tol, 1/4 w	Allen Bradley RP254M	1
R4	044-245	Variable, carbon, linear, 50K ohms, ±20% tol, 1/4 w	Allen Bradley RP503M	1
R5	041-395	Fixed, composition, 1000 ohms, ±5% tol, 1/4 w	RC07GF102J	1
1	46331-2	CIRCUIT BOARD, Printed Wiring		1
2	46532-6	INDICATOR, Equalizer Speed		1
3	492-007	NUT, Plain hex, #2-56 NC-2B, steel, cad pl	MS35649-22	2
4	471-058	SCREW, Machine, #2-56 NC-2A x 1/2 in. lg, slotted pan head, steel, cad pl	MS35225-7	2
5	501-007	WASHER, Flat, #2, steel, cad pl	MS15795-202	2
6	502-023	WASHER, Lock, int. tooth, #2, steel, cad pl	MS35333-35	2

PARTS LIST FOR:	CP-100 PRIMARY POWER SUPPLY (Replacement Parts Only)	CATALOG NO 46360-12	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
		CAPACITORS	
C1	125628-010	Fixed, electrolytic, 6000 μf, 40v dc	1
C2	125628-010	Same as C1	1
		DIODE SEMICONDUCTORS	
CR1	013-334	Silicon, junction — Control Device Corp. CD1122	1
CR2	013-334	Same as CR1	1
CR3	013-334	Same as CR1	1
CR4	013-334	Same as CR1	1
CR5	013-310	Silicon — Westinghouse: 302B 1N1184	1
CR6	013-310	Same as CR5	1
CR7	013-310	Same as CR5	1
CR8	013-310	Same as CR5	1
		CONNECTOR	
P16	145-185	Plug, male, 19 contacts — Winchester SA19P	1
		TRANSFORMERS	
T1	125626-010	Power	1
T2	125627-010	Magnetic Amplifier, encapsulated	1
T3	125627-010	Same as T2	1

CASE ASSEMBLY — CATALOG NO. 46364-10, -20 — Sheet 1 of 2

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO. / SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION 10	20
1	46338-1		CASE WELDMENT ASSEMBLY	1	-
2	46328-1		GRILL, VENT - WELDMENT ASSEMBLY	3	3
4	46263-1		HANDLE, Case	2	-
5	24276-1		SEAL, Air Filter	3	3
6	24277-1		SEAL, Connector Panel	1	-
8	46297-1		ROD, Handle	2	2
9	46318-1		FILTER, Air	3	3
10	46362-1		CHAMBER, Induction	1	-
11	46414-1		GASKET, Fan	1	-
12	46416-1		GASKET, Induction, Chamber	1	-
13	61768-1		CABLE	A/R	A/R
14	11751-1		EMBLEM	1	1
15	145-062	Winchester: M4PLSH10C	CONNECTOR, Plug	1	1
16	302-058		CABLE, Clamp, Plastic 1/8 ID	1	1
17	430-084	Truarc 5133-18S-MD	RING, Retaining, External E, 3/16 in., Steel, Cad. Plt.	4	4
19	471-065	MS35208-17	SCREW, #4-40 NC-2A x 5/8 Lg., Pan Head, Stl. Cad. Plt. Phillips Drive	1	-
20	471-072	MS35208-28	SCREW, #6-32 NC-2A x 5/8 Lg., Pan Head, Stl. Cad. Plt. Phillips Drive	8	-
21	471-274		SCREW, #4-40 NC-2A x 5/16 Lg., 82° C'sk Head, Cross Recessed, Stl. Cad. Plt.	6	-
22	493-005	Esna	NUT, #4-40 NC-2B, Self Locking	1	-
23	493-006	Esna: NM-62	NUT, #6-32 NC-2B, Self Locking	12	-
24	501-014		WASHER, #4, Flat Stl. Cad. Plt.	1	-
25	501-009		WASHER, #6, Flat, Stl. Cad. Plt.	10	9
26	591-027	Rotron: #P9438	FAN, Muffin	2	-
27	018-004	Duco #7 or Equiv.	CEMENT	A/R	-
28	471-408		SCREW, #10-32 x 5/8 82° Flat Head, Phillips Sst., See Note #4	10	10
29	471-141		SCREW, #10-32 x 3/4, Pan Head, Phillips Drive, Sst., See Note #4	24	24
30	501-017		WASHER #10, Flat, Sst., See Note #4	16	16
31	49803-1		CAPACITOR, Metallized, Mylar, 8μf, 300v	1	1
32	49802-1		CAPACITOR, Metallized, Mylar, 4μf, 400v	1	1
33	471-449		SCREW, #6-32 x 1-3/8, Pan Head, Phillips Drive, Stl. Cad. Plt.	-	3
34	125-161-010		CASE WELDMENT ASSEMBLY	-	1

CHANGED 15 AUGUST 1964

CASE ASSEMBLY				CATALOG NO. 46364-10, -20			Sheet 2 of 2
ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION		
					10	20	
35	46263-2			HANDLE	-	2	
36	125280-010			CAPACITOR ASSEMBLY	-	1	
37	591-040			FAN, Papst	-	1	
38	125184-010			SEAL	-	1	
39	503-030	Polymer W-14		WASHER, Flat, Nylon, 1/4 ID x 1/2 OD, x 1/32 THK	-	A/R	
40	260-019			GROMMET	-	1	
41	471-470			SCREW, Machine, Pan Head, Phillips Drive, #6-32 NC-2A x 1-1/2 Lg., Stl. Cad. Plt.	-	1	
42	502-025			WASHER, Lock, Int. Tooth, #6, Steel Cad. Plt.	-	10	
43	492-034			NUT, Hex, Plain #6 -32 NC-2B, Stl. Cad. Plt.	-	8	

CHANGED 15 AUGUST 1964

PARTS LIST FOR:	CP-100 TAPE TRANSPORT	1-inch: CATALOG NO. 46365-50 1/2-inch: CATALOG NO. 46365-60	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
		MOTORS	
B1	23504-01	Take-up, torque, d-c	1
B2	23207-12	Drive, a-c	1
B3	23504-01	Supply, same as B1	1
		CAPACITORS	
C1	037-037	Fixed, tantalum, 80 μf, -15 to +75% tol, 60v dc — Mallory XTHS-806V060POK	1
C2	-------	Fixed, paper, 0.01 μf, ±20% tol, 100v dc (part of FL2)	1
C3	-------	Same as C2 (part of FL1)	1
C4	037-106	Fixed, tantalum, 60 μf, -15 to +50% tol, 50v dc (C2 comprises two of these capacitors wired in parallel for 120 μf) — General Electric 62F404	2
C5	23556-01	Motor, fixed, 4.5 μf	1
C6	037-106	Same as C4	2
		DIODE SEMICONDUCTORS	
CR1	013-305	Silicon — International Rectifier 1N1516A	1
CR2	013-050	Silicon, power — General Electric 1N537	1
CR3	013-050	Same as CR2	1
CR4		Not used	
CR5		Not used	
CR6	013-050	Same as CR2	1
CR7	013-050	Same as CR2	1
CR8	013-308	Silicon — Diodes Inc. 1N3281	1
CR9	013-308	Same as CR8	1
		INDICATOR LAMPS	
DS1A	060-019	Exciter, incandescent, 28v, clear, miniature flanged base, T-1-3/4 type — MS25237-327	1
DS1B	060-019	Same as DS1A	1
		FILTERS	
FL1	23708-01	R-f (includes C3)	1
FL2	23708-01	Same as FL1 (includes C2)	1
		CONNECTORS	
J1	146-132	Receptacle, female, 22 contacts — Continental 600-110GD-7008J	1
J2	169-084	Receptacle, male, 26 contacts — Winchester MRAC-26-P-J6	1
J3	169-081	Receptacle, male, 42 contacts — Winchester MRAC-42-P-J6	1
J4	169-083	Receptacle, female, 20 contacts — Winchester MRAC-20-S-J6	1
J5	169-082	Receptacle, male, 20 contacts — Winchester MRAC-20-P-J6	1
J115	146-129	Receptacle, female, 20 contacts — Continental SM20-20S	1
J125	146-129	Same as J115	1
		RELAYS	
K1	020-076	4P2T, 28v, dc, 400 ohms coil — General Electric CR2791G121D4	1
K2	020-076	Same as K1	1
K3	020-076	Same as K1	1
K4	020-076	Same as K1	1
K5	020-075	2P2T, 28v dc, 12K ohm coil — Iron Fireman R400-20C-12K	1
K6	020-076	Same as K1	1
K7	020-076	Same as K1	1
K8	15873-15	4P2T, 115v dc, 10K ohms coil	1
K9	020-075	Same as K5	1
K10	020-075	Same as K5	1
		SOLENOIDS	
L1	23579-01	Supply brake tension	1
L2	43337-01	Take-up brake tension	1
L3	11147-01	Pinch rollers	1
		RESISTORS	
R1	043-034	Fixed, wirewound, 5 ohms, ±5% tol, 50w — Dale RH50	1
R2	041-540	Fixed, composition, 36 ohms, ±5% tol, 2 w — RC42GF360J	1
R3	044-057	Variable, wirewound, 20K ohms, ±5% tol, 2 w — Helipot GR20KC5	1
R4	041-003	Fixed, composition, 100 ohms, ±5% tol, 1/2 w — RC20GF101J	1
R5	041-003	Same as R4	1
R6		Not used	
R7	043-034	Same as R1	1
R8	043-280	Fixed, wirewound, 50 ohms, ±10% tol, 50 w — Dale B-5C	1
R9	043-375	Fixed, wirewound, 10 ohms, ±10% tol, 25 w — Dale RH-25	1
R10	044-378	Variable, wirewound, 3 ohms, ±10% tol, 25 w — Ohmite H-3-S1	1
		SWITCHES	
S1	120-007	Microswitch, lever-operated — Microswitch DT-2RV-A7	1
S2	46957-01	Rotary, 6 pole, 6 position	1
		PHOTO-ELECTRIC CELLS	
V1	015-014	Part of tape guide assembly — Clairex Crystal CL-404-S	1

PARTS LIST FOR:	CP-100 TAPE TRANSPORT	1-inch: CATALOG NO. 46365-50 1/2-inch: CATALOG NO. 46365-60	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
	18226-01	ARM, Adjusting Collar (R. H.)	1
	18227-01	ARM, Adjusting Collar (L. H.)	1
	1822-01	ARM, Pinch Roller	1
	164822-020	BEARING, Ball, double shield, .250 I. D. x .625 O. D.	2
	164831-020	BEARING, Ball, flanged, .312 I. D. x .688 O. D.	4
	422-007	BEARING, Flanged, .312 I. D. x .440 O. D., 3/8 in. lg.	Oilite F-411-1 4
	23448-01	BELT, Flat, 26-7/8 - 27-1/8 lg.	1
	23448-03	BELT, Flat, 10-3/8 - 10-5/8 lg.	1
	23448-04	BELT, Flat, 15-1/8 - 15-3/8 lg.	1
	23448-05	BELT, Flat, 23-9/16 - 23-13/16 lg.	1
	46276-01	BLOCK ASSEMBLY, PIVOT, TRANSPORT (L. H.)	1
	49302-1	Block (L. H.)	1
	49303-1	Pin, dowel, special	1
	477-034	Screw, set, 6-32 NC-3A x 3/16 in. lg., headless, hex socket, cup point, steel, cad pl.	MS51017-21 1
	46276-2	BLOCK ASSEMBLY, PIVOT, TRANSPORT (R. H.)	1
	49302-2	Block (R. H.)	1
	49303-1	Pin, Dowel, special	1
	477-034	Screw, set, #6-32 NC-3A x 3/16 in. lg., headless, hex socket, cup point, steel, cad pl.	MS51017-21 1
	125885-010	BLOCK ASSEMBLY, TRANSPORT HANDLE	1
	125924-010	Block, transport handle	1
	125924-020	Block, transport handle (opposite side)	1
	125925-010	Pad	1
	406-025	Pin, rollpin, .094 in. dia. x .437 in. lg., stls. stl.	ESNA: 79-022-094-0437 1
	477-144	Screw, set, #6-32 NC-3A x 1/4 in. lg., headless, hex socket, flat point, stls. stl.	AN565AC6H4 1
	46429-03	Stud, fastener	1
	46087-01	BRACKET, Mounting, speed sensing board	1
	125751-010	CAP	1
	23482-1	CAPSTAN ASSEMBLY	1
	24303-1	Capstan Sub-Assembly	1
	24282-1	Flywheel	1
	493-019	Nut, self locking, hex, 5/16 - 24 NF-3B x 0.344 in. thk., steel, cad pl.	ESNA: 42NE-054 1
	477-115	Screw, Set, #8-32 NC-3A x 1/8, headless, hex socket, cup point, steel, cad pl.	MS51017-33 1
	302-006	CLAMP, Cable, 7/16 I. D.	Commercial Plastics 742-7 1
	302-036	CLAMP, Cable, 3/8 in. I. D.	Commercial Plastics 742-6 1
	302-082	CLAMP, Cable, 4 in. lg., white nylon	Thomas & Betts TY-13 1
	302-083	CLAMP, Cable, 7-1/2 in. lg., white nylon	Thomas & Betts TY-15 3
	125096-010	COVER, Harness	1
	23537-3	COVER, Head	1
	23537-4	COVER, Head	1
	46775-03	COVER, Drive Motor	1
	48989-020	DIODE ASSEMBLY, MOTOR TERMINAL (Includes CR8 or CR9)	2
	49221-01	Board, diode mounting, motor terminal	1
	172-013	Lug, solder, 7/8 in. lg.	Birnbach: 96 2
	492-007	Nut, plain, hex, #2-56 NC-2B, steel, cad pl.	MS35649-22 2
	471-103	Screw, machine, #2-56 NC-2A x 3/16 in. lg., slotted, pan hd., stls. steel	MS35233-2 2
	502-023	Washer, flat, int. tooth, #2 steel, cad pl.	MS35333-35 2
	46773-1	DISK ASSEMBLY, SPEED CHANGE SWITCH	1
	46771-11	Disk	1
	46772-11	Decal	1
	125694-010	GUIDE, Tape (1/2 inch)	1(-60)
	125694-020	GUIDE, Tape (1 inch)	1(-50)
	48990-2	GUIDE ASSEMBLY, SHIELD MODIFICATION	1
	23350-02	Guide, tape	1
	125374-010	Shield	1
	60950-12	KNOB ASSEMBLY, REEL HOLD DOWN (1/2-inch)	2(-60)
	60950-13	KNOB ASSEMBLY, REEL HOLD DOWN (1-inch)	2(-50)
	420-010	Ball, nylon, 1/8 in. dia.	Ace Plastic Co.: FM-10001 1
	60849-01	Base Assembly	1
	60852-01	Cover	1
	60850-01	Handle Assembly	1
	402-005	Pin, dowel, 0.125 in. dia. x 0.314 in. lg.	Unbrako 1(-60)
	402-012	Pin, dowel, 0.125 in. dia. x 1 in. lg. stls. stl.	Anti-Corrosive Metal Prod Co. 1(-50)
	471-733	Screw, machine, #10-32 NC-2A x 1-1/2 in. lg., cross-recessed, flat head, steel, cad pl.	MS35193-61 3(-60)
	471-743	Screw, machine, #10-32 NC-2A x 1-3/4 in. lg., slotted flat hd., steel, cad pl.	MS35240-79 3(-50)
	477-031	Screw, set, #4-40 NC-3A x 1/4 in. lg., headless, hex socket, cup point, steel, cad pl.	MS51017-11 2
	477-040	Screw, set, #8-32 NF-2A x 3/16 in. lg., headless, hex socket, cup point, steel, cad pl.	MS51017-34 1
	18233-01	Spacer, 1-inch & 1/2-inch, reel hold down knob	1(-50)
	11139-01	LINK, Cross, tie	4
	23353-1	LINK, Equalizer	1
	46965-01	MOTOR, DRIVE ASSEMBLY (Includes B2)	1
	18881-06	Fanning Strip	1
	492-009	NUT, #6-32 NC-2B, steel, cad pl.	MS35649-62 4
	492-008	NUT, #4-40 NC-2B, steel, cad pl.	MS35649-42 4
	493-007	NUT, #8-32 NC-2B, nylon insert, steel, cad pl.	ESNA: Type NM 1
	125695-010	OVERLAY, Plate	1
	400-004	PIN, Clevis, 1/8 in. dia. x 3/8 in. lg., steel, cad pl.	MS20392-1-11 4
	401-005	PIN, Cotter, 1/16 in. dia. x 1/2 in. lg., steel, cad pl.	4
	406-011	PIN, Rollpin, .028 in. wall, .125 in. dia. x .625 in. lg.	ESNA-59-028-125-0625 2
	169-086	PIN, Connector, male, crimp type, 0.062 in. dia., phosphor bronze	Winchester 100-1024P A/R
	169-080	PIN, Connector, male, crimp type, 0.062 in. dia., bronze	Winchester 100-1014P A/R
	46267-2	PREAMPLIFIER ASSEMBLY	1
	46425-1	Board, assembly, preamplifier connector	1

PARTS LIST FOR:	CP-100 TAPE TRANSPORT	1-inch: CATALOG NO. 46365-50 1/2-inch: CATALOG NO. 46365-60	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
	125913-020	Chassis, preamplifier	1
	125914-020	Cover Assembly, preamplifier	1
	46428-1	Insulator, preamplifier connector board	1
	493-005	Nut, self locking, #4-40 NC-3B, nylon insert, steel, cad pl. ESNA: NM26	4
	169-086	Pin, connector, male, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1024-P	A/R
	169-078	Pin, connector, male, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1020-P	A/R
	46404-1	Plate, insulating	1
	471-063	Screw, machine, #4-40 NC-2A x 7/16 in. lg., cross-recessed, pan hd., steel, cad pl. MS35208-15	12
	471-468	Screw, machine, #4-40 NC-2A x 7/8 in. lg., cross-recessed, pan hd., steel, cad pl. MS35208-19	9
	471-067	Screw, machine, #6-32 NC-2A x 1/4 in. lg., cross-recessed, pan hd., steel, cad pl. MS35208-23	3
	46412-1	Terminal Board Assembly, decoupling	1
	501-002	Washer, #4 flat, brass, cad pl. AN960B	20
	501-009	Washer, flat	3
	502-025	Washer, lock	3
	502-002	Washer, #4 spring lock, steel, cad pl. MS35338-40	16
	23757-1	PULLEY, Flat, drive motor	1
	23546-01	PULLEY IDLER SUB-ASSEMBLY	1
	23382-01	Bushing, sleeve	1
	23347-01	Mount, motor	1
	493-019	Nut, 5/16 - 24 NF-2B, nylon insert, steel, cad pl. ESNA 42NE-054	1
	403-008	Pin, locking, 1/8 in. dia. x 1/2 in. lg., steel, zinc pl. Driv-Lok Type C	2
	403-028	Pin, locking, 3/16 in. dia. x 7/8 in. lg., steel, cad pl. Driv-Lok Type F	1
	23383-01	Pulley, cone	1
	23649-01	Spring	1
	23359-01	Washer, flat	2
	23362-01	Washer, spring tension	1
	23453-01	REEL, Turntable	2
	430-070	RING, Retaining, 5/8 in., flat, internal, steel, zinc pl. Spirolox RRT-62	1
	430-025	RING, Retaining, 5/8 in., flat, internal, steel, zinc pl. Truarc: N5000-62-S-ZD	1
	430-059	RING, Retaining, 5/8 in., bowed, internal, steel, zinc pl. Truarc: N5001-62-S-ZD	1
	125886-010	ROD	1
	23712-010	ROLLER, Capstan Follower	2
	470-021	SCREW, #6-32 NC-3A x 5/8 in. lg., hex socket, cap. hd., steel, cad pl. MS35457-9	2
	470-039	SCREW, #10-32 NF-3A x 5/8 in. lg., hex socket, cap hd., steel, cad pl.	10
	471-064	SCREW, Machine, #4-40 NC-2A x 1/2 in. lg., cross-recessed, pan hd., steel, cad pl. MS35208-16	2
	471-067	SCREW, Machine, #6-32 NC-2A x 1/4 in. lg., cross-recessed, pan hd., steel, cad pl. MS35208-23	1
	471-068	SCREW, Machine, #6-32 NC-2A x 5/8 in. lg., cross-recessed, pan hd., steel, cad pl. MS35208-24	4
	471-069	SCREW, Machine, #6-32 NC-2A x 5/16 in. lg., cross-recessed, pan hd., steel, cad pl. MS35208-25	6
	471-342	SCREW, Machine, #6-32 NC-2A x 1.0 in. lg., cross-recessed, flat hd., steel, cad pl. MS35192-31	4
	471-386	SCREW, Machine, #6-32 NC-2A x 5/16 in. lg., cross-recessed, flat hd., steel, pass. MS35200-24	2
	471-446	SCREW, Machine, #6-32 NC-2A x 1/3 in. lg., cross-recessed, truss hd., steel, cad pl.	5
	471-509	SCREW, Machine, #6-32 NC-2A x 3/4 in. lg., slotted filister hd., steel, cad pl. AN500A6-12	2
	471-510	SCREW, Machine, #8-32 NC-2A x 1/2 in. lg., slotted filister hd., steel, cad pl. AN500A8-8	2
	471-804	SCREW, Machine, #10-32 NF-2A x 1/2 in. lg., cross-recessed, truss hd., stls. stl.	3
	471-005	SCREW, Machine, #2-56 NC-2A x 3/8 in. lg., slotted pan hd., brass, cad pl. MS35229-5	2
	470-145	SCREW, #10-32 NF-2A x 2-3/4 in. lg., hex socket, cap hd., steel, cad pl.	2
	471-606	SCREW, Machine, #6-32 NC-2A x 1/4 in. lg., cross-recessed, truss hd., stls. stl.	23
	23713-010	SCREW, Machine, pinch roller	2
	471-062	SCREW, Machine, #4-40 NC-2A x 3/8 in. lg., cross-recessed, pan hd., steel, cad pl. MS35208-14	8
	470-040	SCREW, #10-32 NF-3A x 3/4 in. lg., hex socket, cap hd., steel, cad pl. MS35458-13	4
	472-040	SCREW, Machine, #8-32 NC x 3/8 in. lg., filister hd., stls. stl. Nylock Corp: M33CR8-32-6E	1
	470-187	SCREW, #10-32 NC-2A x 1-5/8 in. lg., hex socket, cap hd., stls. stl.	1
	470-103	SCREW, #10-24 NC-3A x 5/8 in. lg., hex socket, cap hd., steel, cad pl. MS35457-24	8
	477-114	SCREW, Set, #6-32 NC-3A x 1/8 in. lg., headless, hex socket, cup point MS51017-20	2
	23715-01	SHAFT, Pinch Roller	2
	43449-2	SHIELD, Motor	1
	125437-030	SPACER, Inner Race	1
	11541-01	SPACER, Tape Guide	1
	125750-010	SPOOL, 1/2-inch Tape	1(-60)
	125750-020	SPOOL, 1-inch Tape	1(-50)
	352-004	SPRING, Steel, wavy spring, washer, .265 in. I.D. x .367 in. O.D. x .006 thk. Wallace Barnes: R2	2
	352-006	SPRING, Loading, ball bearing, wavy washer, .440 in. I.D. x .618 in. O.D. x .008 in. thk. Wallace Barnes: R6	1
	310-085	STUD, Snapslide Fastener, 1/4 in. dia., 1-1/16 in. lg., #8-32 mtg., steel, thread AN3199A	1
	46957-1	SWITCH, Speed Change Assembly	1
	46966-01	Terminal Board Assembly	1
	45661-05	TAPE TRANSPORT SUBASSEMBLY (1-inch)	1(-50)
	45661-06	TAPE TRANSPORT SUBASSEMBLY (1/2-inch)	1(-60)
	125409-020	Actuator Assembly, Safety Switch	1
	11477-01	Arm, switching	1
	164863-030	Bearing, ball	4
	11597-01	Brake Assembly, slack take-up	1
	281-004	Clutch, for 0.6250 in bore, 1/4 in. shaft	1
	11284-14	Collar, slack take-up	1
	11476-01	Collar, switch arm	1
	11481-01	Drum, brake, slack take-up	1
	406-030	Pin, rollpin, .028 in. wall, .125 in. dia. x .625 in. lg, stls. stl. ESNA: 79-028-125-0625	2
	430-070	Ring, retaining, 5/8 in., internal, flat, steel, zinc pl. Spirolox RRT-62	2
	430-059	Ring, retaining, 5/8 in., internal, bowed, steel, zinc pl. Truarc N-5001-62-S-ZD	1
	430-025	Ring, retaining, 5/8 in., internal, flat, steel, zinc pl. Truarc N-5000-62-S-ZD	1
	471-060	Screw, machine, #4-40 NC-2A x 1/4 in. lg., cross-recessed, pan hd., steel, cad pl. MS35208-12	1
	477-061	Screw, Set, #6-32 NC-3A x 3/16 in. lg., headless, hex socket, flat point MS51025-18	2
	125410-010	Shaft, take-up tape guide	1
	125437-020	Spacer	1
	125411-020	Spacer	1
	352-006	Spring, loading, ball bearing, wavy spring washer, .440 in. I.D. x .618 O.D. x .008 thk, Wallace Barnes: R4	2
	502-002	Washer, spring lock, #4, .124 in. I.D. x .212 in. O.D. x .031 thk., steel, cad pl. MS35338-40	1
	501-051	Washer, flat, .250 in. I.D. x .437 in. O.D. x .003 in. thk., brass pl.	A/R
	501-055	Washer, Flat, .250 in. I.D. x .437 in. O.D. x .005 in. thk., brass	A/R
	501-058	Washer, Flat, .250 in. I.D. x .375 in. O.D. x .010 in. thk, brass pl.	A/R
	120-138	Actuator, microswitch Microswitch: 11SM39	1
	094-005	Actuator, lever Microswitch: JS-224	1
	125730-010	Anchor, brake	2

PARTS LIST FOR:	CP-100 TAPE TRANSPORT	1-inch: CATALOG NO. 46365-50 1/2-inch: CATALOG NO. 46365-60	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
	23370-50	Arm, Tape Tension (1-inch)	1(-50)
	23370-60	Arm, Tape Tension (1/2-inch)	1(-60)
	125371-020	Arm	1
	23365-10	Guide, tape (1-inch)	1(-50)
	23365-20	Guide, tape (1/2-inch)	1(-60)
	498-023	Nut, self locking, spline, #10-32 NF-3B, steel, cad pl. ESNA: 22ND8	1
	406-029	Pin, spring, 0.028 in. wall, 0.125 in. dia., 0.500 in. lg., stls. stl. ESNA: 79-028-125-0500	1
	23435-01	Shaft, tension arm	1
	23689-01	Screw, set	1
	477-037	Screw, set, #6-32 NC-3A x 3/8 in. lg., headless, hex socket, cup point, steel, cad pl. MS51017-24	1
	45664-30	Arm Assembly, Tape Tension	1
	125370-010	Arm	1
	47306-01	Cam Follower	1
	406-029	Pin, rollpin, 0.028 in. wall, 0.125 in. dia., 0.500 in. lg., stls. stl. ESNA: 79-028-125-0500	1
	470-031	Screw, #8-32 NC-2A x .314 in. lg., hex socket head, steel, cad pl. MS35457-17	2
	23435-01	Shaft	1
	502-004	Washer, spring lock, .178 in. I.D. x .296 in. O.D. x .053 in. thk, steel, cad pl. MS35335-42	2
	125696-010	Arm Assembly, Tape Break	1
	125413-010	Arm, tape break	1
	11285-15	Pin, slack take-up	1
	471-327	Screw, machine, #4-40 NC-2A x 5/16 in. lg., cross-recessed, flat hd., steel, cad pl. MS35190-222	1
	23617-2	Bar, Spacer, head cover	2
	164831-020	Bearing, ball, flanged	4
	126156-010	Block, mounting (safety switch)	1
	126091-010	Bracket, connector	1
	23349-02	Bracket, angle, bumper	1
	43520-02	Bracket, stop	1
	43787-02	Brake Band Assembly	2
	11207-2	Band, supply brake	1
	125368-010	Bolt, brake band	1
	11220-01	Bolt, supply brake band	1
	11236-11	Lining, supply brake, tape transport	1
	493-006	Nut, self locking, #6-32 NC-3B, nylon insert, steel, cad pl.	1
	406-021	Pin, rollpin, 0.032 in. wall, 0.156 in. dia. x 0.375 in. lg., stls. stl. ESNA: 79-032-156-0375	2
	302-037	Clamp, cable, 5/16 in. I.D. Commercial Plastic 742-5	2
	302-036	Clamp, cable, 3/8 in. I.D. Commercial Plastic 742-6	2
	126355-010	Guide, brake band	1
	126356-010	Guide, brake band	1
	125749-010	Guide Assembly, Tape (1/2-inch)	1(-60)
	125749-020	Guide Assembly, Tape (1-inch)	1(-50)
	164823-020	Bearing, ball	2
	125751-010	Cap	1
	472-040	Screw, machine, #8-32 NC x 3/8 in. lg., filister hd., stls. stl. Nylock Corp: M33CR8-32-6E	1
	126435-010	Shaft	1
	125437-030	Spacer	1
	11541-1	Spacer, tape guide	1
	125750-030	Spool (1/2-inch tape)	1(-60)
	125750-040	Spool (1-inch tape)	1(-50)
	352-006	Spring, loading, ball bearing, wavy washer, .440 in. I.D. x .618 in. O.D. x .008 in. thk. Wallace Barnes: R6	1
	352-004	Spring, steel, wavy spring washer, .265 in. I.D. x .367 in. O.D. x .006 in. thk. Wallace Barnes: R2	2
	430-025	Ring, retaining, 5/8 in., flat, internal, steel, zinc pl. Truarc: N5000-62-S-ZD	1
	430-070	Ring, retaining, 5/8 in., flat, internal, steel, zinc pl. Spirolox RRT-62	1
	172-003	Lug, solder, internal tooth, #6 Shakeproof 2104-06	2
	173-040	Lug, terminal, feed thru, teflon Sealectro FT-410	2
	173-041	Lug, terminal, stand-off, ceramic Cambridge Therionics X1995A	8
	498-023	Nut, spline, #10-32 NF-2B, steel, cad pl. ESNA: 22ND8-02	4
	492-008	Nut, plain, hex, #4-40 NC-2B, steel, cad pl. MS35649-42	4
	493-006	Nut, self locking, #6-32 NC-3B, nylon insert, steel, cad pl.	8
	492-011	Nut, plain, hex, #10-32 NF-2B, steel, cad pl. MS35650-102	2
	493-007	Nut, self locking, #8-32 NC-2B, nylon insert, steel, cad pl.	4
	169-076	Pin, connector, female, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1020S	A/R
	169-085	Pin, connector, female, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1024S	1
	169-076	Pin, connector, female, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1020S	1
	169-078	Pin, connector, male, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1020P	1
	169-086	Pin, connector, male, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1024P	1
	169-078	Pin, connector, male, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1020P	A/R
	169-086	Pin, connector, male, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1024P	A/R
	405-012	Pin, groove, .0937 in. dia. x 1/2 in. lg., steel, cad pl. Groov-pin Type S	4
	169-085	Pin, connector, female, crimp type, 0.062 in. dia., phosphor bronze Winchester 100-1024S	A/R
	43790-01	Plate, head connection, mounting	1
	46769-01	Relay Assembly (includes C1, K1-K5)	1
	23380-20	Chassis	1
	492-008	Nut, plain, hex, #4-40 NC-2B, steel, cad pl. MS35649-42	2
	492-009	Nut, plain, hex, #6-32 NC-2B, steel, cad pl. MS35649-62	12
	502-013	Washer, lock, #4, ext. tooth, .123 in. I.D. x .260 in. O.D. x .019 in. thk, steel, cad pl. MS35335-29	2
	502-014	Washer, lock, #4, ext. tooth, .150 in. I.D. x .320 in. O.D. x .022 in. thk, steel, cad pl. MS35335-30	12
	46770-02	Relay Assembly (includes K6, K7, R10)	1
	45668-03	Bracket, relay	1
	492-009	Nut, plain, hex, #6-32 NC-2B, steel, cad pl. MS35649-62	6
	502-014	Washer, lock, #4, ext. tooth, .150 in. I.D. x .320 in. O.D. x .022 in. thk, steel, cad pl. MS35335-30	6
	23353-11	Resistor, Sub-Assembly (Includes R3)	1
	403-029	Pin, drive, .09375 in. dia. x 1.375 in. lg., steel, cad pl. Driv-Lok Pin Co. Type B	1
	23471-01	Shaft, follower	1
	501-106	Washer, flat, .281 in. I.D. x .625 in. O.D. x .080 thk, steel, cad pl. MS15795-210	1
	23477-01	Washer, flat	1
	430-082	Ring, retaining, 5/16 in., external flat, stls. stl. Truarc 5100-31-W	2

PARTS LIST FOR: CP-100 TAPE TRANSPORT

1-inch: CATALOG NO. 46365-50
1/2-inch: CATALOG NO. 46365-60

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
	471-468	Screw, machine, #6-32 NC-2A x 5/8 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35208-24	2
	471-073	Screw, #6-32 NC-3A x 3/4 in. lg., hex socket, cap hd., stls. stl.		4
	470-010	Screw, #4-40 NC-3A x 3/8 in. lg., hex socket, cap hd., steel, cad pl.	MS35457	1
	470-070	Screw, #6-32 NC-3A x 7/16 in. lg., hex socket, cap hd., steel, cad pl.		2
	471-061	Screw, machine, #4-40 NC-2A x 5/16, cross-recessed, pan hd., steel, cad pl.	MS24584-13	2
	471-064	Screw, machine, #4-40 NC-2A x 1/2 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35208-16	2
	471-065	Screw, machine, #4-40 NC-2A x 5/8 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35208-17	1
	471-068	Screw, machine, #6-32 NC-2A x 5/8 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35208-24	9
	471-069	Screw, machine, #6-32 NC-2A x 5/16 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35208-25	12
	471-071	Screw, machine, #6-32 NC-2A x 1/2 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35208-27	2
	471-072	Screw, machine, #6-32 NC-2A x 5/8 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35208-28	2
	471-090	Screw, machine, #10-32 NF-2A x 5/8 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35209-56	2
	471-138	Screw, machine, #10-32 NF-2A x 7/16 in. lg., cross-recessed, stls. stl., passivated	MS35217-54	1
	471-329	Screw, machine, #4-40 NC-2A x 7/16 in. lg., cross-recessed, flat hd., steel, cad pl.	MS35192-15	4
	471-336	Screw, machine, #6-32 NC-2A x 3/8 in. lg., cross-recessed, flat hd., steel, cad pl.	MS35192-25	1
	471-380	Screw, machine, #4-40 NC-2A x 5/16 in. lg., cross-recessed, flat hd., stls. stl.	MS35200-13	2
	477-066	Screw, machine, #6-32 NC-2A x 3/16 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35208-22	1
	471-073	Screw, machine, #6-32 NC-2A x 3/4 in. lg., cross-recessed, pan hd., steel, cad pl.	MS35208-29	3
	470-010	Screw, #4-40 NC-3A x 3/8 in. lg., hex socket, cap hd., steel, cad pl.	MS35457	3
	23223-01	Solenoid Assembly (Includes L3)		1
	23468-01	Arm, rotary solenoid		1
	403-008	Pin, locking, 1/8 in. dia. x 1/2 in. lg., steel, zinc pl.	Driv-Lok: Type C	1
	403-015	Pin, driv-lok, .0625 in. dia. x .500 in. lg., steel, cad pl.	Driv-Lok: Type C	1
	406-030	Pin, rollpin, .028 in. wall x .125 in. dia. x .615 in. lg., stls. stl.	ESNA: 79-028-125-0625	1
	43448-01	Spacer, 1-1/4-inch lg.		2
	280-013	Spacer, 1-inch lg., internal threads both ends #6-32 x 1/4 in. deep, anodized aluminum	PIC Design FI-1	1
	280-016	Spacer, 1/4 in. O.D., 3/8 in. lg., threaded #6-32, brass, cad pl.	H. H. Smith 2121	1
	280-004	Spacer, 9/64 in. I.D., 3/8 in. O.D., 1/4 in. lg., brass, cad pl.	H. H. Smith 2110	1
	45670-20	Spring Assembly, Rewind Brake		1
	23369-01	Mounting		1
	471-442	Screw, machine, #6-32 NC-2A x 3/7 in. lg., cross-recessed, pan hd., steel, cad pl.		2
	45674-1	Spring		1
	502-003	Washer, spring, lock, #6, .151 in. I.D. x .253 in. O.D., x .037 in. thk, steel, cad pl.	MS35338-41	2
	47309-01	Spring, brake		2
	23364-01	Spring, follower arm		1
	11668-01	Spring, hanger, safety switch arm		1
	9368-01	Spring, safety switch arm		1
	23510-2	Spring, tape tension arm		1
	46768-12	Time Delay Assembly (Includes C4, CR2, K9, R4)		1
	46768-20	Time Delay Assembly (Includes C6, CR3, K10, R5)		1
	23710-2	Bracket, angle (-12 version		1
	23710-3	Bracket, angle (-20 version only)		1
	471-326	Screw, machine, #4-40 NC-2A x 1/4 in. lg., cross-recessed, flat hd., steel, cad pl.	MS35192-12	2
	502-050	Washer, lock, #4, ext. csk., steel, cad pl.	MS35336-3	2
	501-009	Washer, flat, #6, .156 in. I.D. x .375 in. O.D. x .065-.036 in. thk., steel, cad pl.	MS15795-206	2
	501-092	Washer, spring, .492 in. O.D. x .319 in. I.D. x .010 in. thk., steel, cad pl.	Bellville BS-R3	12
	502-003	Washer, spring lock #6, .151 in. I.D. x .253 in. O.D. x .037 in. thk., steel, cad pl.	MS35338-41	2
	501-009	Washer, flat, #6, .156 in. I.D. x .377 in. O.D. x .065-.036 in. thk., steel, cad pl.	MS15795-206	9
	501-051	Washer, flat, .250 in. I.D. x .437 in. O.D. x .003 in. thk., brass pl.		A/R
	501-055	Washer, flat, .250 in. I.D. x .437 in. O.D. x .005 in. thk., brass		A/R
	501-058	Washer, flat, .250 in. I.D. x .375 in. O.D. x .010 in. thk., brass pl.	Tilley	A/R
	502-002	Washer, spring lock #4, .124 in. I.D. x .212 O.D. x .031 in. thk.	MS35338-40	11
	502-003	Washer, spring lock #6, .151 in. I.D. x .253 in. O.D. x .037 in. thk., steel, cad pl.	MS35338-41	30
	502-005	Washer, spring lock #10, .205 in. I.D. x .337 in. O.D. x .053 in. thk., steel, cad pl.	MS35338-43	4
	502-014	Washer, lock #4, ext. tooth, .150 in. I.D. x .320 in. O.D. x .022 in thk., steel, cad pl.	MS35335-30	1
	502-050	Washer, lock #4, ext. csk., steel, cad pl.	MS35336-3	2
	501-010	Washer, flat, #8, .375 in. O.D. x .036 in. thk., steel, cad pl.	MS15795-207	2
	23714-01	WASHER, Shouldered and Recessed		2
	503-047	WASHER, Nylon, 1/4 in. I.D. x 5/8 in. O.D. x 0.063 in. thk.	Birnbach 6597	2
	501-092	WASHER, Spring, .492 in. O.D. x .319 in. I.D. x .010 in. thk., steel, cad pl.	Bellville BS-R3	16
	502-004	WASHER, Spring Lock, .178 in. I.D. x .296 in. O.D. x .053 in. thk., steel, cad pl.	MS35338-42	1
	501-010	WASHER, Flat #8, .375 in. O.D. x .036 in. thk., steel, cad pl.	MS15795-207	1
	501-051	WASHER, Flat, .250 in. I.D. x .437 in. O.D. x .003 in. thk., brass pl.		A/R
	501-058	WASHER, Flat, .250 in. I.D. x .375 in. O.D. x .010 in. thk., brass pl.	Tilley	A/R
	502-003	WASHER, Spring, lock #6, .151 in. I.D. x .253 in. O.D. x .037 in. thk., steel, cad pl.	MS35338-41	15
	502-005	WASHER, Spring, lock, #10, .205 in. I.D. x .337 in. O.D. x .053 in. thk., steel, cad pl.	MS35338-43	24
	502-013	WASHER, Lock, #4, ext. tooth, .123 in. I.D. x .260 in. O.D. x .019 in. thk., steel, cad pl.	MS35335-29	2
	502-024	WASHER, Lock, #4, int. tooth, steel, cad pl.	MS35333-36	8
	501-019	WASHER, Flat, #10, .203 in. I.D. x .438 in. O.D. x .032 in. thk., steel, cad pl.	AN960-102	16
	502-004	WASHER, Spring, lock, #8, .178 in. I.D. x .296 in. O.D. x .066 thk., steel, cad pl.	MS35338-42	4
	501-009	WASHER, Flat, #6, .156 in. I.D. x .375 in. O.D. x .065 in. thk., steel, cad pl.	MS15795-206	14
	502-014	WASHER, Lock #4, ext. tooth, .150 in. I.D. x .320 in. O.D. x .022 in. thk., steel, cad pl.	MS35335-30	4
	503-030	WASHER, Flat, nylon, 1/4 in. I.D. x 1/2 in. O.D. x 1/32 in. thk.	Polymer W-14	A/R

PARTS LIST FOR:	CP-100 CAPSTAN DRIVE INVERTER (Replacement Parts Only)	CATALOG NO. 46370-11	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
		CAPACITORS	
C1	-------	Factory Determined	1
C2	034-213	Fixed, mica, 150 pf, ±5% tol, 500v dc — Elmenco DM15F151J	1
C3	-------	Factory Determined	1
C4	034-933	Fixed, mica, 500 pf, ±5% tol, 300v dc — Elmenco DM15F501J	1
C5	034-213	Same as C2	1
C6	030-057	Fixed, ceramic, .01 µf, -20 to +80% tol, 5v dc — Sprague 19C214	1
C7	034-213	Same as C2	1
C8	034-933	Same as C4	1
C9	034-933	Same as C4	1
C10	034-213	Same as C2	1
C11	030-057	Same as C6	1
C12	034-213	Same as C2	1
C13	034-933	Same as C4	1
C14	037-068	Fixed, tantalum, 15 µf, ±20% tol, 20v dc — Sprague 156X0020B2	1
C15	125635-010	Fixed, metallized paper, .047 µf, ±.03% tol, 200v dc	1
C16	125636-010	Fixed, metallized paper, .68 µf, ±.03% tol, 100v dc	1
C17	037-068	Same as C14	1
C18	031-220	Fixed, electrolytic, 250 µf, -10 to +100% tol, 12v dc — Sprague 30D157A1	1
C19		Not used	
C20	037-068	Same as C14	1
C21	031-287	Fixed, electrolytic, 100 µf, 25v dc — Illinois SMT10025	1
C22	031-287	Same as C21	1
C23	037-068	Same as C14	1
C24	031-287	Same as C21	1
C25	031-134	Fixed, electrolytic, -10 to +150% tol, 50v dc — Cornell Dubilier BR500-50	1
C26	031-287	Same as C21	1
C27	031-134	Same as C25	1
C28	033-999	Fixed, metallized, .5 µf, ±20% tol, 50v dc — Westcap WS4504	1
C29	034-933	Same as C4	1
C30	034-213	Same as C2	1
C31	030-057	Same as C6	1
C32	034-213	Same as C2	1
C33	034-933	Same as C4	1
C34	034-933	Same as C4	1
C35	034-213	Same as C2	1
C36	030-057	Same as C6	1
C37	034-213	Same as C2	1
C38	034-933	Same as C4	1
C39	034-933	Same as C4	1
C40	034-213	Same as C2	1
C41	030-057	Same as C6	1
C42	034-213	Same as C2	1
C43	034-933	Same as C4	1
C44	034-933	Same as C4	1
C45	034-213	Same as C2	1
C46	030-057	Same as C6	1
C47	034-213	Same as C2	1
C48	034-933	Same as C4	1
C49	034-933	Same as C4	1
C50	034-213	Same as C2	1
C51	030-057	Same as C6	1
C52	034-213	Same as C2	1
C53	034-933	Same as C4	1
C54	037-028	Fixed, tantalum, 22 µf, ±20% tol, 15v dc — Sprague 150D226X0015B2	1
C55	037-028	Same as C54	1
C56	033-093	Fixed, metallized, paper, .22 µf, ±20% tol, 100v dc — Electron WI-224	1
C57	030-057	Same as C6	1
C58	030-057	Same as C6	1
C59	030-057	Same as C6	1
C60	033-093	Same as C54	1
C61	037-068	Same as C14	1
		DIODE SEMICONDUCTORS	
CR1	013-334	Silicon — Control Devices Corp. CD1122	1
CR2	013-334	Same as CR1	1
CR3	013-334	Same as CR1	1
CR4	013-334	Same as CR1	1
CR5	013-334	Same as CR1	1
CR6	013-334	Same as CR1	1
CR7	013-334	Same as CR1	1
CR8	013-239	Silicon — Control Devices Corp. CD32488	1
CR9	013-334	Same as CR1	1
CR10	013-334	Same as CR1	1
CR11	013-334	Same as CR1	1
CR12	013-334	Same as CR1	1
CR13	013-225	Zener, ±5% tol, 10 watt — IRC 10Z22T5 (1N1608A)	1
CR14	582-053	Silicon — IRC 12F5	1
CR15	013-334	Same as CR1	1
CR16	013-334	Same as CR1	1
CR17	013-334	Same as CR1	1
CR18	013-334	Same as CR1	1
CR19	013-334	Same as CR1	1
CR20	013-334	Same as CR1	1
CR21	013-334	Same as CR1	1
CR22	013-334	Same as CR1	1
CR23	013-334	Same as CR1	1
CR24	013-334	Same as CR1	1
CR25	013-334	Same as CR1	1
		INDUCTORS	
L1	125635-010	Fixed, 350 h	1
L2	125636-010	Fixed, 7 h	1

PARTS LIST FOR:	CP-100 CAPSTAN DRIVE INVERTER (Replacement Parts Only)	CATALOG NO. 46370-11	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
		CONNECTORS	
P18	145-190	Plug, male, 9 contacts	Winchester SA9P	1
		TRANSISTORS	
Q1	1220049	Silicon, NPN		1
Q2	1220049	Same as Q1		1
Q3	014-105	Germanium, NPN	Sylvania 2N1304	1
Q4	014-105	Same as Q3		1
Q5	014-105	Same as Q3		1
Q6	014-105	Same as Q3		1
Q7	014-105	Same as Q3		1
Q8	014-105	Same as Q3		1
Q9	1220049			1
Q10	014-215	Germanium, PNP	Philco 2N2374	1
Q11	014-105	Same as Q3		1
Q12	014-164	Germanium, PNP	Texas Instruments 2N251	1
Q13	014-157	Germanium, PNP	Texas Instruments 2N1099	1
Q14	014-157	Same as Q13		1
Q15	014-105	Same as Q3		1
Q16	014-105	Same as Q3		1
Q17	014-105	Same as Q3		1
Q18	014-105	Same as Q3		1
Q19	014-105	Same as Q3		1
Q20	014-105	Same as Q3		1
Q21	014-105	Same as Q3		1
Q22	014-105	Same as Q3		1
Q23	014-105	Same as Q3		1
Q24	014-105	Same as Q3		1
Q25	014-105	Same as Q3		1
Q26	014-105	Same as Q3		1
Q27	014-105	Same as Q3		1
Q28	014-105	Same as Q3		1
Q29	014-105	Same as Q3		1
		RESISTORS	
R1	041-020	Fixed, composition, 47 K ohms, ±5% tol, 1/2 watt	RC20GF473J	1
R2	-------	Factory Determined		1
R3	041-010	Fixed, composition, 2 K ohms, ±5% tol, 1/2 watt	RC20GF202J	1
R4	-------	Factory Determined		1
R5	041-016	Fixed, composition, 22 K ohms, ±5% tol, 1/2 watt	RC20GF223J	1
R6	041-420	Fixed, composition, 12 K ohms, ±5% tol, 1/2 watt	RC20GF423J	1
R7	041-343	Fixed, composition, 6.8 K ohms, ±5% tol, 1/2 watt	RC20GF681J	1
R8	041-009	Fixed, composition, 1.8 K ohms, ±5% tol, 1/2 watt	RC20GF182J	1
R9	041-329	Fixed, composition, 330 ohms, ±5% tol, 1/2 watt	RC20GF331J	1
R10	041-009	Same as R8		1
R11	041-420	Same as R6		1
R12	041-343	Same as R7		1
R13	041-016	Same as R5		1
R14	041-017	Fixed, composition, 33 K ohms, ±5% tol, 1/2 watt	RC20GF333J	1
R15	041-420	Same as R6		1
R16	041-343	Same as R7		1
R17	041-009	Same as R8		1
R18	041-329	Same as R9		1
R19	041-009	Same as R8		1
R20	041-420	Same as R6		1
R21	041-343	Same as R7		1
R22	041-017	Same as R14		1
R23	041-020	Same as R1		1
R24	041-331	Fixed, composition, 3.3 K ohms, ±5% tol, 1/2 watt	RC20GF332J	1
R25	041-023	Fixed, composition, 100 K ohms, ±5% tol, 1/2 watt	RC20GF104J	1
R26	041-246	Fixed, composition, 82 K ohms, ±5% tol, 1/2 watt	RC20GF823J	1
R27	041-330	Fixed, composition, 6.8 K ohms, ±5% tol, 1/2 watt	RC20GF682J	1
R28	041-014	Fixed, composition, 10 K ohms, ±5% tol, 1/2 watt	RC20GF103J	1
R29	041-017	Same as R14		1
R30	-------	Factory Determined		1
R31	041-014	Same as R28		1
R32	041-309	Fixed, carbon, 8.2 K ohms, ±5% tol, 1/2 watt	RC20GF822J	1
R33	041-239	Fixed, carbon, 2.2 K ohms, ±5% tol, 1/2 watt	RC20GF222J	1
R35	-------	Factory Determined		1
R36	044-310	Variable, wirewound, 2 K ohms, 1/4 watt	Bourns 275P-1-202	1
R37	-------	Factory Determined		1
R38	043-517	Fixed, wirewound, 390 ohms, 3 watt	Ohmite 7/16-A-54F	1
R39	125633-010	Resistance wire, .1 ohm		1
R40	043-520	Fixed, wirewound, 39 ohms, ±5% tol, 3 watt	Ohmite 7/16-A-54F	1
R41	041-017	Same as R14		1
R42	041-420	Same as R6		1
R43	041-343	Same as R7		1
R44	041-009	Same as R8		1
R45	041-329	Same as R9		1
R46	041-009	Same as R8		1
R47	041-420	Same as R6		1
R48	041-343	Same as R7		1
R49	041-017	Same as R14		1
R50	041-020	Same as R1		1
R51	041-420	Same as R6		1
R52	041-343	Same as R7		1
R53	041-009	Same as R8		1
R54	041-329	Same as R9		1
R55	041-009	Same as R8		1
R56	041-420	Same as R6		1
R57	041-343	Same as R7		1
R58	041-020	Same as R1		1
R59	041-020	Same as R1		1
R60	041-420	Same as R6		1
R61	041-343	Same as R7		1

PARTS LIST FOR: CP-100 CAPSTAN DRIVE INVERTER — CATALOG NO. 46370-11

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
R62	041-009	Same as R8		1
R63	041-329	Same as R9		1
R64	041-009	Same as R8		1
R65	041-420	Same as R6		1
R66	041-343	Same as R7		1
R67	041-020	Same as R1		1
R68	041-022	Fixed, carbon, 68 K ohms, ±5% tol, 1/2 watt	RC20GF683J	1
R69	041-420	Same as R6		1
R70	041-343	Same as R7		1
R71	041-009	Same as R8		1
R72	041-329	Same as R9		1
R73	041-009	Same as R8		1
R74	041-420	Same as R6		1
R75	041-343	Same as R7		1
R76	041-022	Same as R68		1
R77	041-022	Same as R68		1
R78	041-420	Same as R6		1
R79	041-343	Same as R7		1
R80	041-009	Same as R8		1
R81	041-329	Same as R9		1
R82	041-009	Same as R8		1
R83	041-420	Same as R6		1
R84	041-343	Same as R7		1
R85	041-022	Same as R68		1
R86	041-245	Fixed, composition, 1 K ohms, ±5% tol, 1/2 watt	RC20GF102J	1
R87	041-018	Fixed, composition, 39 K ohms, ±5% tol, 1/2 watt	RC20GF393J	1
R88	041-245	Same as R86		1
R89	041-254	Fixed, composition, 15 K ohms, ±5% tol, 1/2 watt	RC20GF153J	1
R90	041-344	Fixed, composition, 390 ohms, ±5% tol, 1/2 watt	RC20GF391J	1
R91	041-254	Same as R89		1
R92	041-018	Same as R87		1
R93	041-245	Same as R86		1
R94	041-014	Same as R28		1
R95	041-245	Same as R86		1
R96	041-498	Fixed, composition, 24 K ohms, ±5% tol, 1/2 watt	RC20GF243J	1
R97	041-014	Same as R28		1
R98	041-014	Same as R28		1
R99	041-498	Same as R96		1
R100	041-014	Same as R28		1
R101	041-245	Same as R86		1
R102	044-310	Same as R36		1
R104	041-018	Same as R87		1
R105	041-003	Fixed, composition, 100 K ohms, ±5% tol, 1/2 watt	RC20GF101J	1
R106	041-245	Same as R86		1
R107	041-233	Same as R25		1
		TRANSFORMERS		
T1	125637-010	Driver		1
T2	125638-010	Output		1
T3	125639-010	Current		1
		SWITCHES		
TS1	021-007	Thermal, SPST	Fenwall 32410-01	1
		CRYSTALS		
Y1	125640-010	Piezo-electric, 7.680 kc, ±0.001% tol		1

RECORD/REPRODUCE COVER ASSEMBLY				CATALOG NO. 46372-20		Sheet 1 of 1
ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION	
					20	
1	46341-1			COVER WELDMENT	-	
2	46406-1			PLUNGER ASSEMBLY	1	
3	17382-1			EMBLEM TRADEMARK	1	
4	23607-1			FRAME, WINDOW	1	
5	24272-20			STRIKE, Latch	1	
6	46292-1			HINGE, Cover	1	
7	46293-1			WINDOW, Cover	1	
8	46313-1			GASKET, Switch	1	
9	46386-1			HANDLE, Cover	-	
10	46387-1			PLATE, Switch	1	
11	46393-1			ARM, Cover Stop	1	
12	46394-1			SLIDE, Cover Stop	1	
13	61941-1			SPRING, Helical, Compression	1	
14	018-008	3MEC870 or Equiv.		ADHESIVE	A/R	
15	269-114	Rubber Craft #251		EXTRUSION	1	
16	406-023			PIN, Rollpin, 1/16 Dia. x 1/2 Lg., Stainless Steel	1	
17	471-065	MS35208-17		SCREW, Machine, #4-40 NC-2A x 5/8 Lg., Pan Head, Cross Recess, Stl. Cad. Plt.	1	
18	471-328	MS35192-13		SCREW, Machine, #4-40 NC-2A x 3/8 Lg., 82° C'sk Flat, Cross Recess, Stl. Cad. Plt.	13	
19	476-003			SCREW, #4-40 NC-2A x 1/4 Lg., Self-tapping Binder Hd. Type F	16	
20	493-005	ESNA NM-26		NUT, Self Locking, Nylon Insert, #4-40 NC-3B	15	
21	497-008			NUT, Speednut, 3/32 Dia.	2	
22	501-014	MS15795-304		WASHER, Flat, #4, Stls. Stl., Passivated	14	
23	503-037			WASHER, Non-Metallic, .190 ID x 3/8 OD, 1/32 THK.	2	
24	471-112	MS35208-14		SCREW, Machine, #4-40 NC-2A x 3/8 Lg., Pan Head, Cross Recess, Sst.	-	
25	11751-1			PLATE, Identification	1	
26		Eastman: 910 or Equiv.			A/R	
27	48558-1			BUSHING, Cover, Stop	1	
28	125162-010			COVER WELDMENT	1	
29	125164-020			HANDLE	1	

CHANGED 15 AUGUST 1964

PARTS LIST FOR:	CP-100 ELECTRONICS POWER SUPPLY (Replacement Parts Only)	CATALOG NO. 46380-13	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
		CAPACITORS	
C1	030-184	Fixed, ceramic, .001 µf, ±20% tol, 500v dc	Centralab: MFT1000	1
C2	030-184	Same as C1		1
C3	031-287	Electrolytic, 100 µf, ±20% tol, 25v dc	Illinois SMT10025	1
C4	031-287	Same as C3		1
C5	031-287	Same as C3		1
C6	031-287	Same as C3		1
C7	030-184	Same as C1		1
C8	030-184	Same as C1		1
C9	031-287	Same as C3		1
C10	031-287	Same as C3		1
C11	030-184	Same as C1		1
C12	030-184	Same as C1		1
C13	035-919	Fixed, metallized, .5 µf, ±5% tol, 100v dc	Goodall: X663F	1
C14	031-220	Fixed, electrolytic, 250 µf, -10% +100% tol, 12v dc	Sprague: 30D157A1	1
C15	031-287	Same as C3		1
C16	031-287	Same as C3		1
C17	031-220	Same as C14		1
C18	030-184	Same as C1		1
C19	030-184	Same as C1		1
C20	030-184	Same as C1		1
C21	030-184	Same as C1		1
C22	030-184	Same as C1		1
C23	030-184	Same as C1		1
C24	031-220	Same as C14		1
C25	030-184	Same as C1		1
C26	031-287	Same as C3		1
C27	030-184	Same as C1		1
C28	030-184	Same as C1		1
C29	031-287	Same as C3		1
C30	030-184	Same as C1		1
C31	031-220	Same as C14		1
C32	030-184	Same as C1		1
C33	031-287	Same as C3		1
C34	031-287	Same as C3		1
C35	030-184	Same as C1		1
C36	030-184	Same as C1		1
C37	030-184	Same as C1		1
C38	030-184	Same as C1		1
C39	030-184	Same as C1		1
C40	030-184	Same as C1		1
C41	030-184	Same as C1		1
C42	031-220	Same as C14		1
C43	031-287	Same as C3		1
C44	030-184	Same as C1		1
C45	030-184	Same as C1		1
C46	031-287	Same as C3		1
C47	031-220	Same as C14		1
C48	030-044	Fixed, ceramic, .1 µf, ±20% tol, 75v dc	Centralab: DDA-104	1
C49	030-184	Same as C1		1
C50	031-287	Same as C3		1
C51	031-287	Same as C3		1
C52	030-184	Same as C1		1
C53	030-044	Same as C48		1
C54	031-287	Same as C3		1
C55	031-287	Same as C3		1
C56	030-044	Same as C48		1
C57	030-184	Same as C1		1
C58	030-184	Same as C1		1
C59	030-044	Same as C48		1
C60	031-287	Same as C3		1
C61	031-287	Same as C3		1
C62	030-184	Same as C1		1
C63	030-184	Same as C1		1
C64	030-184	Same as C1		1
C65	030-184	Same as C1		1
C66	030-184	Same as C1		1
C67	030-184	Same as C1		1
C68	037-081	Fixed, tantalum, 8.2 µf, ±20% tol, 30v dc	U.S. Semcor: TS2K-30-825	1
C69	037-081	Same as C68		1
C70	031-287	Same as C3		1
C71	031-287	Same as C3		1
C72	031-287	Same as C3		1
C73	031-287	Same as C3		1
C74	031-287	Same as C3		1
C75	031-287	Same as C3		1
C76	-------	Factory Determined		1
C77	-------	Factory Determined		1
C78	034-933	Fixed, mica, 500 pf, ±5% tol, 300v dc	Elmenco DM15F501J	1
C79	030-976	Fixed, ceramic, .0047 µf, ±20% tol, 250v dc	Sprague 55C36	1
C80	030-976	Same as C79		1
C81	030-057	Fixed, ceramic, .013 µf, -20 to +80% tol, 50v dc	Sprague 19C214	1
C82	030-057	Same as C81		1
C83	030-976	Same as C79		1
C84	030-976	Same as C79		1
C85	031-220	Same as C14		1
C86	031-220	Same as C14		1
C87	031-220	Same as C14		1
C88	031-220	Same as C14		1
C89	030-057	Same as C81		1
C90	034-933	Same as C78		1
C91	037-070	Fixed, tantalum, 4.7 µf, ±10% tol, 35v dc	Sprague 150D475X903582	1
C92	037-070	Same as C91		1
C93	031-287	Same as C3		1
C94	037-068	Fixed, tantalum, 15 µf, ±20% tol, 20v dc	Sprague 150D156X0020B2	1
C95	037-068	Same as C94		1
C96	030-989	Fixed, ceramic, .005 µf, -20 to +80% tol, 50v dc	Sprague 19C242 (T6-D50)	1
C97	030-057	Same as C81		1

PARTS LIST FOR: CP-100 ELECTRONICS POWER SUPPLY (Replacement Parts Only) CATALOG NO. 46380-13

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
C98	034-933	Same as C78		1
C99	030-057	Same as C81		1
C100	031-287	Same as C3		1
C101	034-933	Same as C78		1
		DIODE SEMICONDUCTORS		
CR1	582-053	Silicon	IRC 12F5	1
CR2	013-225	Zener, ±2% tol, 6.8v	IRC10Z22T5 (1N1608A)	
CR3	013-334	Silicon	Control Devices Corp. CD1122	1
CR4	013-334	Same as CR3		1
CR5	013-040	Silicon	Transitron TM-11	
CR6	013-040	Same as CR5		1
CR7	013-040	Same as CR5		1
CR8	013-040	Same as CR5		1
CR9	013-334	Same as CR3		1
CR10	013-334	Same as CR3		1
CR11	013-334	Same as CR3		1
CR12	013-334	Same as CR3		1
CR13	013-334	Same as CR3		1
CR14	013-334	Same as CR3		1
CR15	013-334	Same as CR3		1
CR16	013-334	Same as CR3		1
CR17	013-228	Silicon	Pacific Semiconductor Corp PS005	1
CR18	013-228	Same as CR17		1
CR19	013-240	Silicon	Control Devices Corp. CD32489	1
CR20	013-240	Same as CR19		1
CR21	013-241	Silicon	Control Devices Corp. CD32487	1
CR22	013-241	Same as CR21		1
CR23	013-334	Same as CR3		1
CR24	013-334	Same as CR3		1
CR25	013-240	Same as CR19		1
CR26	013-334	Same as CR3		1
CR27	013-334	Same as CR3		1
CR28	013-334	Same as CR3		1
CR29	013-334	Same as CR3		1
CR30	013-334	Same as CR3		1
CR31	013-334	Same as CR3		1
CR32	013-239	Silicon	Control Devices Corp. CD32488	1
CR33	013-334	Same as CR3		1
CR34	013-334	Same as CR3		1
CR35	013-334	Same as CR3		1
		RELAYS		
K1	020-135	2P2T, coil: 26v dc, 600 ohms resistance	Elgin MV2C600D-24	1
		INDUCTORS		
L1	125643-010	Encapsulated		1
L2	125643-010	Same as L1		1
L3	125643-010	Same as L1		1
L4	125643-010	Same as L1		1
L5	125644-010	Encapsulated		1
L6	125644-010	Same as L5		1
L7	125644-010	Same as L5		1
L8	125644-010	Same as L5		1
L9	125644-010	Same as L5		1
L10	125644-010	Same as L5		1
L11	125644-010	Same as L5		1
L12	125644-010	Same as L5		1
		CONNECTORS		
P20	145-190	Plug, male, 19 contacts	Winchester SA9P	1
		TRANSISTORS		
Q1	014-015	Germanium, PNP	RCA 2N174	1
Q2	014-015	Same as Q1		1
Q3	014-182	Germanium, PNP	Motorola 2N277	1
Q4	014-182	Same as Q3		1
Q5	014-215	Germanium, PNP	Philco 2N2374	1
Q6	014-215	Same as Q5		1
Q7	014-215	Same as Q5		1
Q8	014-215	Same as Q5		1
Q9	014-215	Same as Q5		1
Q10	014-215	Same as Q5		1
Q11	014-105	Germanium, NPN	Sylvania 2N1304	1
Q12	014-105	Same as Q11		1
Q13	014-105	Same as Q11		1
Q14	014-105	Same as Q11		1
Q15	014-270	Silicon, NPN, special		1
Q16	014-270	Same as Q15		1
Q17	014-105	Same as Q11		1
Q18	014-105	Same as Q11		1
Q19	014-105	Same as Q11		1
Q20	014-105	Same as Q11		1
Q21	014-105	Same as Q11		1
Q22	014-105	Same as Q11		1
Q23	014-105	Same as Q11		1
Q24	014-105	Same as Q11		1
Q25	014-105	Same as Q11		1
Q26	014-215	Same as Q5		1
Q27	014-105	Same as Q11		1

PARTS LIST FOR:	CP-100 ELECTRONICS POWER SUPPLY (Replacement Parts Only)	CATALOG NO. 46380-13	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
		RESISTORS	
R1	043-300	Fixed, wirewound, 50 ohms, ±1% tol, 3 watt — Dalohm RS-2B	1
R2	014-023	Fixed, carbon, 100K ohms, ±5% tol, 1/2 watt — RC20GF104J	1
R3	041-023	Same as R2	1
R4	-------	Factory Determined	1
R5	-------	Factory Determined	1
R6	014-003	Fixed, composition, 100 ohms, ±5% tol, 1/2 watt — RC20GF101J	1
R7	041-003	Same as R6	1
R8	041-003	Same as R6	1
R9	041-003	Same as R6	1
R10	041-245	Fixed, composition, 1 K ohm, ±5% tol, 1/2 watt — RC20GF102J	1
R11	041-245	Same as R11	1
R12	044-309	Variable, wirewound, 1 K ohms, ±10% tol, 1/4 watt — Bourns Z75-1-102	1
R13	041-016	Fixed, composition, 22 K ohms, ±5% tol, 1/2 watt — RC20GF223J	1
R14	041-016	Same as R13	1
R15	044-309	Same as R12	1
R16	041-245	Same as R10	1
R17	043-518	Fixed, wirewound, .5 ohms, ±5% tol, 10 watt — Ohmite 1-3/4-D-48-FO.5	1
R18	041-245	Same as R10	1
R19	043-518	Same as R17	1
R20	041-001	Fixed, composition, 5.1 K ohms, ±5% tol, 1/2 watt — RC20GF512J	1
R21	041-001	Same as R20	1
R22	041-303	Fixed, carbon, 3.9 K ohms, ±5% tol, 1/2 watt — RC20GF392J	1
R23	041-303	Same as R22	1
R24	041-245	Same as R10	1
R25	041-245	Same as R10	1
R26	041-343	Fixed, composition, 680 ohms, ±5% tol, 1/2 watt — RC20GF681J	1
R27	041-343	Same as R26	1
R28	041-455	Fixed, composition, 6.2 K ohms, ±5% tol, 1/2 watt — RC20GF622J	1
R29	041-455	Same as R28	1
R30	041-343	Same as R26	1
R31	041-343	Same as R26	1
R32	041-329	Fixed, composition, 330 ohms, ±5% tol, 1/2 watt — RC20GF331J	1
R33	041-329	Same as R32	1
R34	041-343	Same as R26	1
R35	041-343	Same as R26	1
R36	046-013	Thermistor, 3 K ohms, ±10% tol — Victory 33D2	1
R37	046-013	Same as R3	1
R38	041-405	Fixed, composition, 1.2 K ohms, ±5% tol, 1/2 watt — RC20GF122J	1
R39	041-405	Same as R38	1
R40	041-003	Same as R6	1
R41	041-003	Same as R6	1
R42	125633-010	Resistance wire, 0.1 ohm, 1-3/4 in. lg	1
R43	044-308	Variable, wirewound, 100 ohms, ±10% tol, 1/4 watt — Bourns: 275P-1-101	1
R44	044-308	Same as R43	1
R45	125633-010	Same as R42	1
R46	041-343	Same as R26	1
R47	041-343	Same as R26	1
R48	041-014	Fixed, carbon, 10 K ohms, ±5% tol, 1/2 watt — RC20GF103J	1
R49	041-014	Same as R48	1
R50	-------	Factory Determined	1
R51	-------	Factory Determined	1
R52	-------	Factory Determined	1
R53	-------	Factory Determined	1
R54	-------	Factory Determined	1
R55	044-470	Variable, conductive glass, 500 ohms, ±10% tol, 1-1/2 watt — Beckman Helitrim Mod. 53	1
R56	042-076	Deposited, film, 1.5 K ohms, ±1% tol, 1/2 watt — Campbell: CVF	1
R57	042-076	Same as R56	1
R58	044-470	Same as R55	1
R59	-------	Factory Determined	1
R60	041-016	Same as R13	1
R61	041-014	Same as R48	1
R62	041-014	Same as R48	1
R63	041-016	Same as R13	1
R64	041-475	Fixed, composition, 3 K ohms, ±5% tol, 1/2 watt — RC20GF302J	1
R65	041-475	Same as R64	1
R66	041-404	Fixed, composition, 510 ohms, ±5% tol, 1/2 watt — RC20GF511J	1
R67	041-404	Same as R66	1
R68	041-475	Same as R64	1
R69	041-475	Same as R64	1
R70	041-014	Same as R48	1
R71	041-014	Same as R48	1
R72	041-016	Same as R13	1
R73	041-016	Same as R13	1
R74	041-027	Fixed, composition, 220 K ohms, ±5% tol, 1/2 watt — RC20GF224J	1
R75	041-001	Same as R20	1
R76	041-245	Same as R10	1
R77	041-245	Same as R10	1
R78	041-001	Same as R20	1
R79	041-027	Same as R74	1
R80	041-455	Same as R28	1
R81	041-529	Fixed, composition, 20 K ohms, ±5% tol, 1/2 watt — RC20GF203J	1
R82	041-018	Fixed, composition, 39 K ohms, ±5% tol, 1/2 watt — RC20GF393J	1
R83	041-009	Fixed, composition, 1.8 K ohms, ±5% tol, 1/2 watt — RC20GF182J	1
R84	041-404	Same as R66	1
R85	041-020	Fixed, composition, 47 K ohms, ±5% tol, 1/2 watt — RC20GF473J	1
R86	041-357	Fixed, composition, 5.6 K ohms, ±5% tol, 1/2 watt — RC20GF562J	1
R87	041-014	Same as R48	1
R88	041-001	Same as R2	1
R89	041-020	Same as R85	1
R90	041-014	Same as R48	1
R91	041-001	Same as R20	1
R92	041-014	Same as R48	1
R93	041-015	Fixed, composition, 27 K ohms, ±5% tol, 1/2 watt — RC20GF273J	1
R94	041-404	Same as R66	1
R95	041-245	Same as R10	1
R96	041-004	Same as R66	1

PARTS LIST FOR:

CP-100 FM REPRODUCE FILTER UNIT — CATALOG NO. 46390-11 thru 46390-61

REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
	46390-11	FM Reproduce Filter Unit; color code: brown; 60 ips; includes C14, C27 and C28	
	46390-21	FM Reproduce Filter Unit; color code: red; 30 ips; includes C14, C27 and C28	
	46390-31	FM Reproduce Filter Unit; color code: orange; 15 ips; includes C14, C27 and C28	
	46390-41	FM Reproduce Filter Unit; color code: yellow; 7-1/2 ips; includes C14, C27 and C28	
	46390-51	FM Reproduce Filter Unit; color code: green; 3-3/4 ips; includes C14, C27 and C28	
	46390-61	FM Reproduce Filter Unit; color code: blue; 1-7/8 ips; includes C14, C27 and C28	

CAPACITANCE VALUES VS. CATALOG NO.

CATALOG NO.	C14	C27	C28
46390-11	150 pf	1000 pf	420 pf
46390-21	330 pf	2000 pf	880 pf
46390-31	680 pf	3900 pf	1800 pf
46390-41	1500 pf	8200 pf	3600 pf
46390-51	2700 pf	0.016 pf	7250 pf
46390-61	4700 pf	0.033 pf	0.0145 pf

This page is deleted. The frequency-determining units formerly listed here are not used with the new FM record amplifier, catalog 1810217-01.

PARTS LIST FOR:	CP-100 FRAME ASSEMBLY		CATALOG NO. 46410-20	
REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		INDICATOR LAMPS		
DS11	-------	See S11		1
DS12	-------	See S12		1
DS13	-------	See S13		1
DS14	-------	See S14		1
DS15	-------	See S15		1
DS16	-------	See S16		1
		FUSES		
F1	070-020	Cartridge, slow blow, 125v, 5a	Littelfuse 313005	1
F2	070-007	Cartridge, fast blow, 250v, 5a	Littelfuse 312005	1
F3	070-007	Same as F2		1
		CONNECTORS		
J1 thru J14		Not used		
J15	146-185	Receptacle, female, 19 contacts	Deutsch DM9606-19S	1
J16	146-181	Receptacle, female, 19 contacts	Winchester SA19S	1
J17	147-174	Receptacle, crimp, 1 contact	Deutsch MDR00-194P	1
J18	146-180	Receptacle, female, 9 contacts	Winchester SA9S	1
J19	146-062	Receptacle, female, 4 contacts	Winchester M45-LRN	1
J20	146-180	Same as J19		1
J21	146-181	Same as J18		1
J101 thru J114	168-029	Printed circuit board, 22 contacts	Continental Connector 600-110GD-700K	14
J115 thru J117		Not used		
J118 thru J131	142-026	Receptacle, coaxial, female, 1 contact	UG-1094/U	14
J201 thru J214	168-029	Same as J101		14
J215 thru J217		Not used		
J218 thru J231	142-026	Same as J118		14
P1		Not used		
P2	169-115	Plug, female, removable contacts	Winchester MRAC26SJTC648	1
P3	144-136	Plug, female, 20 contacts	Winchester MRAC20SJTC6H13	1
P4	145-170	Plug, male, 20 contacts	Winchester MRAC20PJTC6H13	1
P5	144-135	Plug, female, 42 contacts	Winchester MRAC42SJTC6H8	1
P200	144-138	Plug, female, 7 contacts	Continental Connector C7-20S-VS/C38GC	1
		RESISTORS		
R200	041-003	Fixed, composition, 100 ohms, ±5% tol, 1/2 w	RC20GF101J	1
		SWITCHES (& INDICATOR ASSEMBLIES)*		
S11	49301-6	Power (includes DS11)*		1
S12	49301-3	Drive (includes DS12)*		1
S13	49301-1	Fast Forward (includes DS13)*		1
S14	49301-2	Rewind (includes DS14)*		1
S15	49301-4	Record (includes DS15)*		1
S16	49301-5	Stop (includes DS16)*		1
S17	120-116	Toggle, DPDT	Torsion Balance DP1	1
S18	120-115	Pushbutton, NC	Grayhill 30-2	1
		TEST POINTS		
TP1	148-011	White, nylon	Ucinite 118930-A	1
TP2	148-012	Red, nylon	Ucinite 118930-B	1
TP3	148-012	Same as TP2		1
TP4	148-013	Black, nylon	Ucinite 118930-C	1
TP5	148-011	Same as TP1		1
TP6	148-011	Same as TP1		1
		FUSEHOLDERS		
XF1 thru XF3	085-005	Extractor post, knob type, 3 AG post, 0.505 in. dia. mtg. hole	Littelfuse 342004	3
	120-114	BARRIER, Switch, mounting	Electrosnap 117-SA19-4	8
	46329-2	BEZEL, Switch, mounting		1
	125852-010	BRACKET, Connector mounting panel		1
	125852-020	BRACKET, Connector mounting panel		1
	125619-010	BRACKET, Connector panel, mounting		1
	125763-010	BRACKET, Support arm retainer		1
	125549-010	BRACKET, Bezel mounting		1
	125999-010	BOLT, Latch		1
	302-074	CLAMP, Cable, nygrip, 1/4 in. black nylon	Weckesser: Type 3	2
	302-076	CLAMP, Cable, nygrip, 3/8 in. black nylon	Weckesser: Type 6	5
	302-077	CLAMP, Cable, nygrip, 1/2 in. black nylon	Weckesser: Type 6	5
	302-078	CLAMP, Cable, nygrip, 5/8 in. black nylon	Weckesser: Type 6	4
	302-112	CLAMP, Cable, 1/2 in. x 2 in. rubber covered	T. A. Mfg. Co. 501-D4-500	1

PARTS LIST FOR:	CP-100 FRAME ASSEMBLY	CATALOG NO. 46410-20	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
	474-049	CROSS PIN	Monadnock Mills 294424	2
	46272-1	ENCLOSURE, 14 Channel		1
	46272-2	ENCLOSURE, 14 Channel		1
	46316-1	FILLER, End		2
	46333-1	FUSE PANEL ASSEMBLY		1
	46335-1	Chassis, fuse panel		1
	46334-2	Door Assembly, fuse panel		1
	430-164	Ring, grip, 1/8 in. grip ring, steel, cad pl	Truarc: 5555-12-MF	2
	352-015	Spring, 3/16 in. dia. x 1-3/8 in. lg.	General Cement: H410F	2
	503-048	Washer, flat, #6, 5/32 in. I. D. x 5/16 in. O. D. x .031 thk, nylon	Birnbach: 6S94	4
	46359-1	GUIDE, Bolt		1
	46422-1	HARNESS, Wiring, power branch (includes J15, J17, P2, P200)		1
	46423-1	HARNESS, Wiring, signal branch (includes P3, P4, P5)		1
	172-044	LUG, Soldering, 7/8 in. lg. x .016 in. thk	Birnbach: No. 4	28
	46332-1	MOLDING, Case Foot		4
	493-005	NUT, Self locking, 4-40 NC-3B, nylon insert, steel, cad pl	ESNA NM-26	110
	493-006	NUT, self locking, 6-32 NC-3B, nylon insert, steel, cad pl		30
	493-008	NUT, self locking, 10-32 NF-3B, nylon insert, steel, cad pl	ESNA NM-26	10
	493-027	NUT, self locking, 1/4-28 NF-3B, nylon insert, steel, cad pl		4
	492-009	NUT, 6-32 NC-2B, steel, cad pl	MS35649-62	6
	125620-010	PANEL, Connector mounting		1
	46357-1	PIN, Alignment		8
	46345-1	PIVOT, Cover stop		1
	11751-1	PLATE, Identification		1
	46275-1	PLATE, Connector mounting		1
	46275-2	PLATE, Connector mounting		1
	125546-010	PLATE, Adjustment, connector		1
	125546-020	PLATE, Adjustment, connector		1
	125547-010	PLATE, Adjustment, connector		1
	125547-020	PLATE, Adjustment, connector		1
	471-060	SCREW, Machine, 4-40 NC-2A x 1/4 in. lg., cross-recessed, pan hd	MS24584-12	1
	471-061	SCREW, Machine, 4-40 NC-2A x 5/16 in. lg., cross-recessed, pan hd, steel, cad pl	MS24584-13	2
	471-062	SCREW, Machine, 4-40 NC-2A x 3/8 in. lg., cross-recessed, pan hd, steel, cad pl	MS35208-14	16
	471-063	SCREW, Machine, 4-40 NC-2A x 7/16 in. lg., cross-recessed, pan hd, steel, cad pl	MS24584-15	24
	471-065	SCREW, Machine, 4-40 NC-2A x 5/8 in. lg., cross-recessed, pan hd, steel, cad pl	MS35208-17	4
	471-069	SCREW, Machine, 6-32 NC-2A x 5/16 in. lg., cross-recessed, pan hd, steel, cad pl	MS35208-25	23
	471-070	SCREW, 6-32 NC-3A x 7/16 in. lg., hex socket, cap hd, steel, cad pl		6
	471-071	SCREW, Machine, 6-32 NC-2A x 1/2 in. lg., cross-recessed, pan hd, steel, cad pl	MS35208-27	14
	471-072	SCREW, Machine, 6-32 NC-2A x 5/8 in. lg., cross-recessed, pan hd, steel, cad pl	MS35208-28	23
	471-090	SCREW, Machine, 10-32 NF-2A x 5/8 in. lg., cross-recessed, pan hd, steel, cad pl	MS35209-56	4
	471-885	SCREW, Machine, 4-40 NC-2A x 7/16 in. lg., recessed, 100° ctr. snk., steel, cad pl	AN507-440R7	12
	471-884	SCREW, Machine, 4-40 NC-2A x 1/2 in. lg., recessed, 100° ctr. snk., steel, cad pl	AN507-440R8	8
	471-883	SCREW, Machine, 6-32 NC-2A x 7/16 in. lg., recessed, 100° ctr. snk., steel, cad pl	AN507-632R7	4
	471-882	SCREW, Machine, 10-32 UNF-3A x 21/32 in. lg., recessed, 100° ctr. snk., steel, cad pl	AN509-10R10C	4
	471-959	SCREW, Machine, 4-40 NC-2A x 5/8 in. lg., slotted, pan hd, steel, cad pl		56
	471-075	SCREW, Machine, 6-32 NC-2A x 1 in. lg., cross-recessed, pan hd, steel, cad pl	MS35208-31	2
	471-449	SCREW, Machine, 6-32 NC-2A x 1-3/8 in. lg., cross-recessed, pan hd, steel, cad pl	MS35208	5
	471-360	SCREW, Machine, 10-32 NF-2A x 1 in. lg., cross-recessed, flat hd, steel, cad pl	MS35193-59	1
	471-436	SCREW, Machine, 6-32 NC-2A x 1-5/8 in. lg., cross-recessed, pan hd, steel, cad pl	MS35208	4
	46407-1	SEAL, Molded		1
	46408-1	SEAL, Frame to case		1
	280-011	SPACER, 3/8 in. O. D. x 3/4 in. lg., brass, cad pl	H. H. Smith: 218	9
	125621-010	SPACER, Connector panel		2
	125548-010	SPACER, Enclosure mounting		2
	125874-010	SPACER, Transport pivot		1
	46377-1	SPRING, Cover, latch		1
	474-065	STUD, Airloc, cross-recessed, flush hd	Monadnock: 294426-3-260	2
	46281-2	SUPPORT, Transport pivot, left		1
	46279-2	SUPPORT, Transport pivot, right		1
	125868-010	SUPPORT ARM, Transport, stop		1
	180-061	TERMINAL STRIP, Phenolic	Jones 9-141W-MS-9-141	1
	501-008	WASHER, Flat #4, .125 in. I. D. x .312 O. D. x .040 thk, steel, cad pl	MS15795-204	110
	501-009	WASHER, Flat #6, .156 in. I. D. x .375 in. O. D. x .065-.036 in. thk, steel, cad pl	MS15795-206	83
	501-011	WASHER, Flat #10, .218 in. I. D. x .437 in. O. D. x .065 thk, steel, cad pl	MS15795-208	10
	501-025	WASHER, Flat, .265 in. I. D. x .500 in. O. D. x .032 in. thk, steel, cad pl	AN960-416L	4
	501-106	WASHER, Flat, .281 in. I. D. x .625 in. O. D. x .080 in. thk, steel, cad pl	MS15795-210	4
	503-030	WASHER, Flat, nylon, 1/4 in. I. D. x 1/2 in. O. D. x 1/32 in. thk	Polymer: W-14	1
	502-003	WASHER, Spring, lock #6, .151 in. I. D. x .253 in. O. D. x .037 in. thk, steel, cad pl	MS35338-41	46
	502-013	WASHER, Lock #4, external tooth, .123 in. I. D. x .260 in. O. D. x .019 in. thk, steel, cad pl	MS35335-29	2
	502-077	WASHER, Lock, internal tooth, .377 in. I. D. x .493 in. O. D. x .022 in. thk, steel, cad pl	Shakeproof 1220-02	28
	502-014	WASHER, Flat, external tooth, .150 in. I. D. x .320 in. O. D. x .022 in. thk	MS35335-30	4
	125458-020	WELDMENT		1

PARTS LIST FOR:

CP-100 PDM REPRODUCE AMPLIFIER CARD — CATALOG NO. 46420-1

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	030-094	Fixed, ceramic, 1 μf, ±20% tol, 25v dc	Sprague 5C13	1
C2		Factory determined (approximately 500 pf)		1
C3	030-094	Same as C1		1
C4	030-977	Fixed, ceramic, 1000 pf, 250v dc	Sprague 40C274	1
C5	030-057	Fixed, ceramic, 0.01 μf, -20 to +80% tol, 50v dc	Sprague 19C214	1
C6	030-977	Same as C4		1
C7	030-094	Same as C1		1
C8	033-065	Fixed, metallized paper, 0.05 μf, ±20% tol, 50v dc	Hopkins PO5P5D	1
C9	035-331	Fixed, tubular, 4700 pf, ±5% tol, 100v dc	Goodall 663-UW	1
C10	034-943	Fixed, mica, 27 pf, ±5% tol, 500v dc	Sangamo D15F1427J	1
C11	037-028	Fixed, tantalum, 22 μf, ±20% tol, 15v dc	Sprague 150D226X0015B2	1
C12	034-213	Fixed, mica, 150 pf, ±5% tol, 500v dc	Elmenco DM15F151J	1
C13	030-095	Fixed, ceramic, 1 μf, ±20% tol, 25v dc	Sprague 5C7	1
C14	037-028	Same as C11		1
C15	034-933	Fixed, mica, 500 pf, ±5% tol, 300v dc	Sangamo D15F06350J	1
C16	034-933	Same as C15		1
C17	030-095	Same as C13		1
C18	031-220	Fixed, electrolytic, 250 μf, -10 to +100% tol, 12v dc	Sprague 30D157A1	1
C19	031-220	Same as C18		1
C20	031-220	Same as C18		1
C21	031-220	Same as C18		1
		DIODE SEMICONDUCTORS		
CR1	013-334	Silicon	Control Devices CD1122	1
CR2	013-334	Same as CR1		1
CR3	013-334	Same as CR1		1
CR4	013-334	Same as CR1		1
CR5	013-334	Same as CR1		1
CR6	013-451	Zener, 7.4v	Control Devices CD32625	1
C7		Same as CR6		1
		INDUCTORS		
L1	540-015	Fixed, 1 mh, ±5% tol, 1/3 w	Essex WEE-1000	1
L2	540-015	Same as L1		1
		TRANSISTORS		
Q1	1220026-10	Silicon, NPN	Fairchild S3224	1
Q2	1220026-10	Same as Q1		1
Q3	1220026-10	Same as Q1		1
Q4	1220026-10	Same as Q1		1
Q5	1220026-10	Same as Q1		1
Q6	1220026-10	Same as Q1		1
Q7	1220026-10	Same as Q1		1
Q8	1220026-10	Same as Q1		1
Q9	1220026-10	Same as Q1		1
Q10	014-181	Germanium, PNP	Texas Instruments 2N1377	1
Q11	1220026-10	Same as Q1		1
		RESISTORS		
R1	-------	Factory determined (approximately 100 ohms)		1
R2	-------	Factory determined (approximately 1000 ohms)		1
R3	041-020	Fixed, composition, 47K ohms, ±5% tol, 1/2 w	RC20GF473J	1
R4	041-331	Fixed, composition, 3300 ohms, ±5% tol, 1/2 w	RC20GF332J	1
R5	041-010	Fixed, composition, 2000 ohms, ±5% tol, 1/2 w	RC20GF202J	1
R6	-------	Factory determined (approximately 100 ohms)		1
R7	041-010	Same as R3		1
R8	041-001	Fixed, composition, 5100 ohms, ±5% tol, 1/2 w	RC20GF512J	1
R9	041-014	Fixed, composition, 10K ohms, ±5% tol, 1/2 w	RC20GF103J	1
R10	041-014	Same as R9		1
R11	041-001	Same as R8		1
R12	-------	Factory determined (approximately 150 ohms)		1
R13	041-009	Fixed, composition, 1800 ohms, ±5% tol, 1/2 w	RC20GF182J	1
R14	041-404	Fixed, composition, 510 ohms, ±5% tol, 1/2 w	RC20GF511J	1
R15	041-009	Same as R13		1
R16	044-308	Variable, wirewound, 100 ohms, ±10% tol, 1/4 w	Bourns 275P-1-102	1
R17	041-303	Fixed, composition, 3900 ohms, ±5% tol, 1/2 w	RC20GF392J	1
R18	041-014	Same as R9		1
R19	041-001	Same as R8		1
R20	-------	Factory determined (approximately 47 ohms)		1
R21	041-014	Same as R9		1
R22	041-001	Same as R8		1
R23	-------	Factory determined (approximately 1800 ohms)		1
R24	041-286	Fixed, composition, 1.0 megohm, ±5% tol, 1/2 w	RC20GF105J	1
R25	044-304	Variable, carbon, 200K ohms, ±20% tol, 1/5 w	Bourns 276-1-204	1
R26	041-016	Fixed, composition, 22K ohms, ±5% tol, 1/2 w	RC20GF223J	1
R27	041-014	Same as R9		1
R28	041-254	Fixed, composition, 15K ohms, ±5% tol, 1/2 w	RC20GF153J	1
R29	041-017	Fixed, composition, 33K ohms, ±5% tol, 1/2 w	RC20GF333J	1
R30	041-010	Same as R5		1
R31	041-245	Fixed, composition, 1000 ohms, ±5% tol, 1/2 w	RC20GF102J	1
R32	041-001	Same as R8		1
R33	-------	Factory determined (approximately 4700 ohms)		1
R34	041-278	Fixed, composition, 2700 ohms, ±5% tol, 1/2 w	RC20GF272J	1
R35	041-014	Same as R9		1
R36	041-014	Same as R9		1
R37	041-245	Same as R31		1
R38	041-245	Same as R31		1
R39	041-245	Same as R31		1
R40	-------	Factory determined		1

PARTS LIST FOR:

CP-100 PDM REPRODUCE AMPLIFIER CARD — CATALOG NO. 46420-11

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		RESISTORS		
R41	041-016	Same as R26		1
RT1	046-012	Thermistor, 100K ohms, ±10% tol	Victory 51R2	1
		SWITCHES		
S1	120-984	Toggle, miniature, SPDT	Torsion Balance SP-3-A. 2	
		TEST POINTS		
TP1	148-039	Black, 0.655 in. lg x 0.286 in. dia., 0.218 in. dia mtg hole	Raytheon 276-1570G6	1
TP2	148-042	White, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole	Raytheon 276-1570G9	1
TP3	148-038	Red, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole	Raytheon 276-1570G4	1
1	1220194-10	BRACKET, Switch mounting		1
2	127040-10	CIRCUIT BOARD, Printed wiring		1
3	1220193-10	HANDLE, Extractor		1
4	46417-10	INSULATOR, Shield		1
5	1220158-10	PLUG, Shorting		3
6	1220158-20	PLUG, Shorting		3
7	472-088	SCREW, Machine, pan head, cross-recessed drive, #2-56 x 3/16 in. lg, steel, cad pl	MS24584-2	3
8	472-089	SCREW, Machine, pan head, cross-recessed drive, #2-56 x 5/16 in. lg, steel, cad pl	MS24584-4	2
9	150-103	SOCKET, Transistor mounting, insulated	Elco 3303	11
10	280-047	SPACER, Transistor	Milton Roes 10109-DAP	10
11	148-065	TEST POINT, Yellow, sub-miniature, 0.187 in. dia x 0.312 in. lg	E. F. Johnson 105-857	12
12	502-001	WASHER, Lock, spring #2, steel, cad pl	MS35338-39	5

PARTS LIST FOR:

CP-100 CONTROL TRACK GENERATOR CARD — CATALOG NO. 46730-30

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	031-205	Fixed, electrolytic, 5 μf, -10 to +100% tol, 50v dc	Sprague 30D193A1	1
C2	034-212	Fixed, mica, 330 pf, ±5% tol, 500v dc	Elmenco DM15E331J	1
C3	031-166	Fixed, electrolytic, 100 μf, -10% to +250% tol, 6v dc	Sprague 30D135A1	1
C4	034-177	Fixed, mica, 100 pf, ±5% tol, 500v dc	Elmenco DM15F101J	1
C5	031-205	Same as C1		1
C6	034-177	Same as C4		1
C7	031-205	Same as C1		1
C8	037-080	Fixed, tantalum, 10 μf, ±20% tol, 25v dc	US Semcor TS2K-25-106	1
C9	033-052	Fixed, metallized, 0.001 μf, ±5% tol, 200v dc	Electron Products DI-2-162D	1
C10	034-180	Fixed, mica, 39 pf, ±5% tol, 500v dc	Elmenco DM15E390J	1
C11	033-053	Fixed, metallized, 0.0022 μf, ±10% tol, 200v dc	Electron Products DI-2-222E	1
C12	037-116	Fixed, tantalum, 150 μf, ±20% tol, 15v dc	Texas Instruments Type SCM	1
C13	030-095	Fixed, ceramic, 0.1 μf, ±20% tol, 25v dc	Sprague 5C7	1
C14	037-116	Same as C12		1
C15 thru C20	030-095	Same as C13		6
C21	037-038	Fixed, tantalum, 25 μf, -15 to +75% tol, 15v dc	Mallory TNT-25-15	1
C22	035-314	Fixed, metallized, 0.022 μf, ±10% tol, 50v dc	Goodall 602	1
C23	037-038	Same as C21		1
C24	030-063	Fixed, ceramic, 0.1 μf, -20 to +80% tol, 50v dc	Sprague 33C41	1
C25	037-038	Same as C21		1
C26	035-323	Fixed, metallized, 0.01 μf, ±10% tol, 100v dc	Goodall X663FR	1
C27	035-314	Same as C22		1
C28	030-100	Fixed, ceramic, 3300 pf, ±10% tol, 500v dc	Erie 811-527-Y5S-332K	1
C29	030-100	Same as C28		1
C30	030-104	Fixed, ceramic, 470 pf, ±10% tol, 500v dc	Erie 811-527-Y5F-471K	1
		DIODE SEMICONDUCTORS		
CR1	013-012	Germanium	Hughes 1N90	1
CR2	013-012	Same as CR1		1
		INDUCTORS		
L1	91014-3	Variable, 25.3 μh		1
L2	91014-2	Variable, 540 μh		1
L3	91014-1	Variable, 12.6 μh		1
L4	540-003	Fixed, 220 μh	Essex WEE-220	1
		TRANSISTORS		
Q1	014-029	Germanium, PNP	General Instruments 2N414	1
Q2	014-029	Same as Q1		1
Q3	014-030	Germanium, NPN	General Instruments 2N446A	1
Q4	014-029	Same as Q1		1
Q5 thru Q7	014-031	Germanium, PNP	General Instruments 2N1065	3
Q8 thru Q12	014-029	Same as Q1		5
		RESISTORS		
R1	044-326	Variable, carbon, 25K ohms, ±20% tol, 1/4 w, linear	Allen Bradley R-RP253M	1
R2	041-407	Fixed, composition, 3300 ohms, ±5% tol, 1/4 w	RC07GF332J	1
R3	042-235	Fixed, deposited film, 1500 ohms, ±1% tol, 1/2 w	Texas Instruments CD1/2PR	1
R4	042-224	Fixed, deposited film, 1910 ohms, ±1% tol, 1/2 w	Texas Instruments CD1/2PR	1
R5	041-412	Fixed, composition, 4700 ohms, ±5% tol, 1/4 w	RC07GF472J	1
R6	041-413	Fixed, composition, 6800 ohms, ±5% tol, 1/4 w	RC07GF682J	1
R7	041-414	Fixed, composition, 2200 ohms, ±5% tol, 1/4 w	RC07GF222J	1
R8	041-406	Fixed, composition, 22K ohms, ±5% tol, 1/4 w	RC07GF223J	1
R9	041-414	Same as R7		1
R10	041-415	Fixed, composition, 68K ohms, ±5% tol, 1/4 w	RC07GF683J	1
R11	041-409	Fixed, composition, 15K ohms, ±5% tol, 1/4 w	RC07GF153J	1
R12	041-410	Fixed, composition, 1000 ohms, ±5% tol, 1/4 w	RC07GF102J	1
R13	041-409	Same as R11		1
R14	041-396	Fixed, composition, 220 ohms, ±5% tol, 1/4 w	RC07GF221J	1
R15	041-396	Same as R14		1
R16	044-264	Variable, composition, linear, 500 ohms, ±20% tol, 1/4 w	Bourns 236P-1-501	1
R17	041-733	Fixed, composition, 56 ohms, ±5% tol, 1/4 w	RC07GF560J	1
R18	041-002	Fixed, composition, 10 ohms, ±5% tol, 1/4 w	RC07GF100J	1
R19	041-421	Fixed, composition, 22 ohms, ±5% tol, 1/4 w	RC07GF220J	1
R20	041-421	Same as R19		1
R21	041-008	Fixed, composition, 1500 ohms, ±5% tol, 1/2 w	RC20GF152J	1
R22	041-417	Fixed, composition, 390 ohms, ±5% tol, 1/4 w	RC07GF391J	1
R23	041-407	Same as R2		1
R24	041-410	Same as R12		1
R25	042-225	Fixed, deposited film, 32.4K ohms, ±1% tol, 1/2 w	Texas Instruments CD1/2PR	1
R26	044-236	Same as R1		1
R27	041-406	Same as R8		1
R28	041-417	Same as R22		1
R29	041-409	Same as R11		1
R30	041-413	Same as R6		1
R31	041-407	Same as R2		1
R32	041-430	Fixed, composition, 1500 ohms, ±5% tol, 1/4 w	RC07GF152J	1
R33	041-436	Fixed, composition, 18K ohms, ±5% tol, 1/4 w	RC07GF183J	1
R34	041-436	Same as R33		1
R35	041-407	Same as R2		1
R36	044-236	Same as R1		1
R37	041-013	Fixed, composition, 4700 ohms, ±5% tol, 1/2 w	RC20GF472J	1

PARTS LIST FOR:

CP-100 CONTROL TRACK GENERATOR CARD — CATALOG NO. 46730-30

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
R38	041-530	Fixed, composition, 15 ohms, ±5% tol, 1/4 w	RC07GF150J	1
R39	041-530	Same as R38		1
		TRANSFORMERS		
T1	46311-1	Interstage		1
T2	46301-1	Bias Input		1
T3	92686-1	Interstage		1
T4	92687-1	Interstage		1
		TEST POINTS		
TP1	148-042	White, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole	Raytheon 276-1570G9	1
TP2	148-038	Red, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole	Raytheon 276-1570G4	1
TP3	148-039	Black, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole	Raytheon 276-1570G6	1
TP4	148-042	Same as TP1		1
TP5	148-041	Blue, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole	Raytheon 276-1570G8	1
TP6	148-040	Green, 0.655 in. lg x 0.286 in. dia, 0.218 in. dia mtg hole	Raytheon 276-1570G7	1
		CRYSTALS (selected at time of purchase of CTG)		
Y1	017-004	Quartz, 17 kc	Monitor Products MC-13	1
Y1	017-003	Quartz, 18.24 kc	Monitor Products MC-13	1
1	126898-01	CIRCUIT BOARD, Printed Wiring		1
2	46417-1	INSULATOR, Shield		1
3	492-007	NUT, Plain hex, #2-56 NC-2B, steel, cad pl	MS35469-22	2
4	47872-1	PANEL, Detail		1
5	471-054	SCREW, Machine, #2-56 NC-2A x 1/4 in. lg, slotted pan head, steel, cad pl	MS35225-3	2
6	417-838	SCREW, Machine, #2-56 NC-2A x 3/16 in. lg, slotted pan head, steel, cad pl	MS35225-2	5
7	46325-1	SHIELD, Subassembly		1
8	150-087	SOCKET, Crystal, printed circuit mounting	Augat 8000-AG4	1
9	150-103	SOCKET, Transistor mounting	Elco 3303	12
10	47867-1	STRAP, Hold-down		1
11	502-023	WASHER, Lock, int. tooth, #2, steel, cad pl	MS35333-35	5

PARTS LIST FOR:

CP-100 REMOTE CONTROL UNIT — CATALOG NO. 48460-01

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		DIAL LAMPS		
DS20A		Incandescent, 28v, midget screw base (part of item 7)	Chicago Miniature Lamp Works #335	1
DS20B		Same as DS20A (part of item 7)		1
DS21A thru DS26A		Same as DS20A (one each in S21 thru S26)		6
DS21B thru DS26B		Same as DS20A (one each in S21 thru S26)		6
		METER		
M1	49322-1	0 to 1.0 ma basic movement		1
		SWITCHES		
S21	49301-6	POWER, pushbutton, illuminated (includes DS21A & DS21B)		1
S22	49301-3	DRIVE, pushbutton, illuminated (includes DS22A & DS22B)		1
S23	49301-1	FAST FORWARD, pushbutton, illuminated (includes DS23A & DS23B)		1
S24	49301-2	REWIND, pushbutton, illuminated (includes DS24A & DS24B)		1
S25	49301-4	RECORD, pushbutton, illuminated (includes DS25A & DS25B)		1
S26	49301-5	STOP, pushbutton, illuminated (includes DS26A & DS26B)		1
		CONNECTOR		
P15	145-109	Plug, male, 19 contacts (part of item 4)	Deutsch DM9702-19P-1A	1
1	120-114	BARRIER	Electrosnap #1117-SA19-4	10
2	48455-01	BASE, Remote control		1
3	250-020	BUMPER		1
4	48453-01	CABLE, Subassembly (includes P15)		4
5	302-049	CLAMP, Cable, plastic, for 1/2 in. cable	Commercial Plastic 742-8	1
6	260-046	GROMMET, Elastic	Rubbercraft RC-21	1
7	49301-7	INDICATOR, Subassembly, illuminated, "FAULT" (includes DS20A & DS20B)		1
8	496-005	NUT, Keps, #6-32 NC-2B, steel, cad pl	Shakeproof	1
9	497-009	NUT, Speednut, push-on, for 1/8 in. stud	Tinnerman C8152-017-67	2
10	48454-01	PANEL, Remote control		1
11	471-387	SCREW, Machine, #6-32 NC-2A x 3/8 in. lg, cross-recessed flat hd, stl steel	MS35200-25	6
12	471-388	SCREW, Machine, #6-32 NC-2A x 7/16 in. lg, cross-recessed flat hd, stl steel	MS35200-26	1
13	501-009	WASHER, Flat, #6, steel cad pl	MS15795-206	1

PARTS LIST FOR:	CP-100 POWER CONTROL CASE (Replacement Parts Only)	CATALOG NO. 48630-10	
REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
		CAPACITORS	
C1	031-220	Electrolytic, 250 μf, -10 to +100% tol, 12v dc — Sprague 30D157A1	1
C2	125628-010		1
C3	037-124	Fixed, tantalum, 35 μf, ±20% tol, 25v dc	1
C4	037-070	Fixed, tantalum, 4.7 μf, ±10% tol, 35v dc — Sprague 150D475X9035B2	1
C5	031-283	Electrolytic, 75 μf, ±10% tol, 50v dc — CD: NLW-347	1
		DIODE SEMICONDUCTORS	
CR1	013-239	Silicon, junction — Control Devices Corp. CD32488	1
CR2	013-334	Silicon, junction — Control Devices Corp CD1122	1
CR3	013-334	Same as CR2	1
		RELAYS	
K1	020-194	3PST; coil, 24v dc, 10A contacts, normally open — Globe Electrical: 3A4P575	1
		INDUCTORS	
L1	-------	Part of T1	-
		CONNECTORS	
P21	145-185	Plug, male, 19 contacts — Winchester SA19P	1
		TRANSISTORS	
Q1	014-213	Germanium, PNP — Motorola: 2N1542	1
Q2	014-213	Same as Q1	1
Q3	014-105	Germanium, NPN — Sylvania 2N1304	1
Q4	014-164	Germanium, PNP — Texas Instruments 2N251	1
		RESISTORS	
R1	043-300	Fixed, wirewound, 50 ohms, ±1% tol, 3 watt — Dalohm RS-2B	1
R2	041-331	Fixed, composition, 3300 ohms, ±5% tol, 1/2 watt — RC20GF332J	1
R3	125634-010	Fixed, resistance wire, 0.1 ohm	1
R4	042-369	Fixed, deposited film, 1500 ohms, ±1% tol, 1/8 watt — Electra: RN60R1501F	1
R5	044-309	Variable, wirewound, 1000 ohms, ±10% tol, 1/4 watt	1
R6	-------	Factory Determined	1
R7	041-245	Fixed, carbon, 1000 ohms, ±5% tol, 1/2 watt — RC20GF102J	1
R8	041-245	Same as R7	1
R9	041-245	Same as R7	1
R10	043-328	Fixed, wirewound, 2000 ohms, ±5% tol, 3 watt — Sprague 242E2025	1
R11	043-520	Fixed, wirewound, 39 ohms, ±5% tol, 3 watt — Ohmite 7116A-54F	1
		TRANSFORMER	
T1	125630-010	Output and Choke Filter	1

ACCESSORY KIT, CP-100 CATALOG NO. 48641-20 Sheet 1 of 1

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION 20
1	616-033			A.C. POWER CORD	-
2	144-091			POWER CONNECTOR	-
3	48640-1			REMOTE CONTROL JUMPER PLUG	1
4	48650-1			CAPSTAN JUMPER PLUG	1
5	46382-1			EXTENSION CARD	1
6	23448-01			DRIVE BELT	1
7	23448-03			DRIVE BELT	1
8	23448-04			DRIVE BELT	1
9	23448-05			DRIVE BELT	1
10	230-050			KNOB	2
11	126815-010			CABLE ASSEMBLY	1

CHANGED 15 AUGUST 1964

PARTS LIST FOR:

CP-100 TRANSPORT SPEED SENSING CONTROL ASSEMBLY — CATALOG NO. 125622-010

REF. NO.	AMPEX PART NO.	DESCRIPTION		NO/ ASSY.
		CAPACITORS		
C1	033-024	Fixed, Metallized paper, 0.1 μf, ±10% tol, 50v dc	Westcap MS4K104	1
C2	033-089	Fixed, metallized paper, 0.039 μf, ±5% tol, 25v dc	Westcap MS4J393	1
C3	033-021	Fixed, metallized paper, 0.01 μf, ±10% tol, 25v dc	Westcap MS4K103	1
C4	033-090	Fixed, metallized paper, 0.082 μf, ±5% tol, 50v dc	Westcap MS4K823	1
C5	033-022	Fixed, metallized paper, 0.022 μf, ±10% tol, 25v dc	Westcap MS4K223	1
C6	033-088	Fixed, metallized paper, 0.033 μf, ±5% tol, 50v dc	Westcap MS4J333	1
C7	037-107	Fixed, tantalum, 2.2 μf, ±20% tol, 35v dc	Sprague 150D225X0035B2	1
C8	033-023	Fixed, metallized paper, 0.047 μf, ±10% tol, 25v dc	Westcap MS4K473	1
C9	037-094	Fixed, tantalum, 10 μf, ±10% tol, 50v,dc	Sprague 109D106X0050C0	1
C10	035-067	Fixed, paper, 0.1 μf, ±10% tol, 400v dc	CP05A3EE104K	1
C11	033-092	Fixed, metallized paper, 0.28 μf, ±5% tol, 50v dc	Westcap MS4J284	1
		DIODE SEMICONDUCTORS		
CR1	013-021	Silicon	Texas Instruments 1N461	1
CR2	013-021	Same as CR1		1
CR3	013-021	Same as CR1		1
CR4	013-021	Same as CR1		1
CR5	013-021	Same as CR1		1
CR6	013-021	Same as CR1		1
CR7	013-021	Same as CR1		1
CR8	013-021	Same as CR1		1
CR9	013-050	Germanium	General Electric 1N537	1
		TRANSISTORS		
Q1	014-013	Silicon, NPN	Texas Instruments 2N332	1
Q2	014-013	Same as Q1		1
Q3	014-013	Same as Q1		1
Q4	014-013	Same as Q1		1
Q5	014-013	Same as Q1		1
Q6	014-013	Same as Q1		1
		RESISTORS		
R1	041-062	Fixed, composition, 15K ohms, ±10% tol, 1/2 w	RC20GF153K	1
R2	041-060	Fixed, composition, 10K ohms, ±10% tol, 1/2 w	RC20GF103K	1
R3	041-025	Fixed, composition, 150K ohms, ±5% tol, 1/2 w	RC20GF154J	1
R4	041-068	Fixed, composition, 47K ohms, ±10% tol, 1/2 w	RC20GF473K	1
R5	041-060	Same as R2		1
R6	041-060	Same as R2		1
R7	041-072	Fixed, composition, 100K ohms, ±10% tol, 1/2 w	RC20GF104K	1
R8	041-546	Fixed, composition, 130K ohms, ±5% tol, 1/2 w	RC20GF134J	1
R9	041-060	Same as R2		1
R10	041-068	Same as R4		1
R11	041-074	Fixed, composition, 150K ohms, ±10% tol, 1/2 w	RC20GF154K	1
R12	041-060	Same as R2		1
R13	041-072	Same as R7		1
R14	041-064	Fixed, composition, 22K ohms, ±10% tol, 1/2 w	RC20GF223K	1
R15	041-076	Fixed, composition, 220K ohms, ±10% tol, 1/2 w	RC20GF224K	1
R16	041-048	Fixed, composition, 1000 ohms, ±10% tol, 1/2 w	RC20GF102K	1
R17	041-046	Fixed, composition, 680 ohms, ±10% tol, 1/2 w	RC20GF681K	1
R18	042-190	Fixed, deposited film, 15K ohms, ±1% tol, 1/2 w	Dale DCSH1/2	1
R19	042-190	Same as R18		1
R20	044-188	Fixed, deposited film, 196K ohms, ±1% tol, 2w	Dale DCF-2	1
1	23532-1	BRACKET, Chassis		1
2	23532-2	BRACKET, Chassis		1
3	125580-010	CIRCUIT BOARD, Printed Wiring		1
4	492-009	NUT, Hex, #6-32 NC-2B, steel, cad pl	MS35469-62	4
5	471-067	SCREW, Machine, cross-recessed drive, pan head, #6-32 NC-2A x 1/4 in. lg, steel, cad pl	MS35208-23	4
6	280-030	SPACER, Transistor	Transipad 10012	6
7	502-025	WASHER, Lock #6, int. tooth, steel, cad pl		4

FM RECORD AMPLIFIER, PRINTED WIRING BOARD ASSEMBLY CATALOG NO. 1810217-01 Sheet 1 of 2

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION 01
1	1220945-10			PRINTED WIRING BOARD	1
2	1220944-10			PANEL FRONT	1
3	46417-1			INSULATOR, Shield	1
4	46325-1			SHIELD	1
5	1220158-30			SHORTING PLUG	2
6	034-239			CAPACITOR, Mica, 130 pf, 1%	5
7	034-375			CAPACITOR, Mica, 145 pf, 1%	1
8	034-287			CAPACITOR, Mica, 300 pf, 1%	1
9	034-372			CAPACITOR, Mica, 620 pf, 1%	1
10	034-383			CAPACITOR, Mica, 1260 pf, 1%	1
11	034-381			CAPACITOR, Mica, 2600 pf, 1%	1
12	034-382			CAPACITOR, Mica, 5300 pf, 1%	1
13	030-057			CAPACITOR, Ceramic, .01 μf, 50v	2
14	035-325			CAPACITOR, Mylar, .1 μf, 20%, 100v	2
15	037-028			CAPACITOR, Tantalum, 22 μf, 20%, 15v	3
16	013-039	1N497		DIODE	1
17	013-054	1N96		DIODE	3
18	051-094			INDUCTOR, Molded, Fixed, 39 μh	3
19	048-025			RESISTOR, Fixed, 21.5K, 1%, 1/2w	1
20	041-002			RESISTOR, Fixed, 10 ohms, 5%, 1/2w	1
21	041-282			RESISTOR, Fixed, 150 ohms, 5%, 1/2w	2
22	041-329			RESISTOR, Fixed, 330 ohms, 5%, 1/2w	2
23	041-430			RESISTOR, Fixed, 1500 ohms, 5%, 1/4w	1
24	041-414			RESISTOR, Fixed, 2200 ohms, 5%, 1/4w	2
25	041-413			RESISTOR, Fixed, 6800 ohms, 5%, 1/4w	2
26	041-408			RESISTOR, Fixed, 10K, 5%, 1/4w	1
27	041-406			RESISTOR, Fixed, 22K, 5%, 1/4w	1
28	041-411			RESISTOR, Fixed, 47K, 5%, 1/4w	1
29	041-415			RESISTOR, Fixed, 68K, 5%, 1/4w	1
30	041-562			RESISTOR, Fixed, 43K, 5%, 1/4w	1
31	041-574			RESISTOR, Fixed, 110K, 5%, 1/4w	1
32	041-760			RESISTOR, Fixed, 270K, 5%, 1/4w	1
33	042-380			RESISTOR, Metal Film, 30.1 ohms, 1%, 1/8w	1
34	042-381			RESISTOR, Metal Film, 619 ohms, 1%, 1/8w	1
35	042-382			RESISTOR, Metal Film, 1000 ohms, 1%, 1/8w	5

CHANGED 15 AUGUST 1964

FM RECORD AMPLIFIER, PRINTED WIRING BOARD ASSEMBLY CATALOG NO. 1810217-01 Sheet 2 of 2

ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION 01
36	042-384			RESISTOR, Metal Film, 10K, 1%, 1/8w	1
37	042-388			RESISTOR, Metal Film, 261K, 1%, 1/8w	1
38	044-450			RESISTOR, Variable, Carbon, 250 ohms	2
39	044-449			RESISTOR, Variable, Carbon 20K	1
40	044-426			RESISTOR, Printed Network, 25K Variable, 325 ohms, Variable, 1750 ohms Fixed, 75K Variable	1
41	91158-10			PRINTED SUB-CIRCUIT SPECIFICATION	1
42	014-105	2N1304		TRANSISTOR	1
43	014-988	2N1305		TRANSISTOR	1
44	014-111	2N1306		TRANSISTOR	2
45	014-138	2N863		TRANSISTOR	1
46	014-989	2N706A		TRANSISTOR	1
47	014-554	CD476		TRANSISTOR, PNP, Dual	1
48	280-136	CO: 10156		TRANSIPAD, Milton Ross Metal	1
49	150-103			SOCKET, Transistor	6
50	69607-10			KNOB, Speed Switch	1
51	69608-10			BASE, Speed Switch	1
52	476-028			SCREW, #4-40, 1/4 Lg., Type F, Pan Head, Slotted, Stl. Cad. Plt.	1
53	501-008			WASHER, Flat #4, Stl. Cad. Plt.	1
54	148-065			TEST JACK, Color: Yellow	3
55	148-064			TEST JACK, Color: Black	4
56	460-013			RIVET, Oval Head, .060 Dia. x .187 Lg.	2
57	471-055			SCREW, #2-56 x 5/16 Lg., Pan Head, Slotted Stl. Cad. Plt.	2
58	471-053			SCREW, #2-56 x 3/16 Lg., Pan Head, Slotted Stl. Cad. Plt.	3
59	502-001			WASHER, Spring Lock, #2	7
60	615-002			WIRE, Bare #22 Awg	A/R
61	49260-1			PLATE IDENTIFICATION AND TRADE-MARK	1
62	471-054			SCREW, Slotted, Pan Head, #2-56-1/4 Lg.	2
63	492-007			NUT, #2-56	2
64	148-038		TP3	JACK, Test Point, Red	1
65	148-039		TP2	JACK, Test Point, Black	1
66	148-042		TP1	JACK, Test Point, White	1
67	122-093			SWITCH, Rotary	1

CHANGED 15 AUGUST 1964

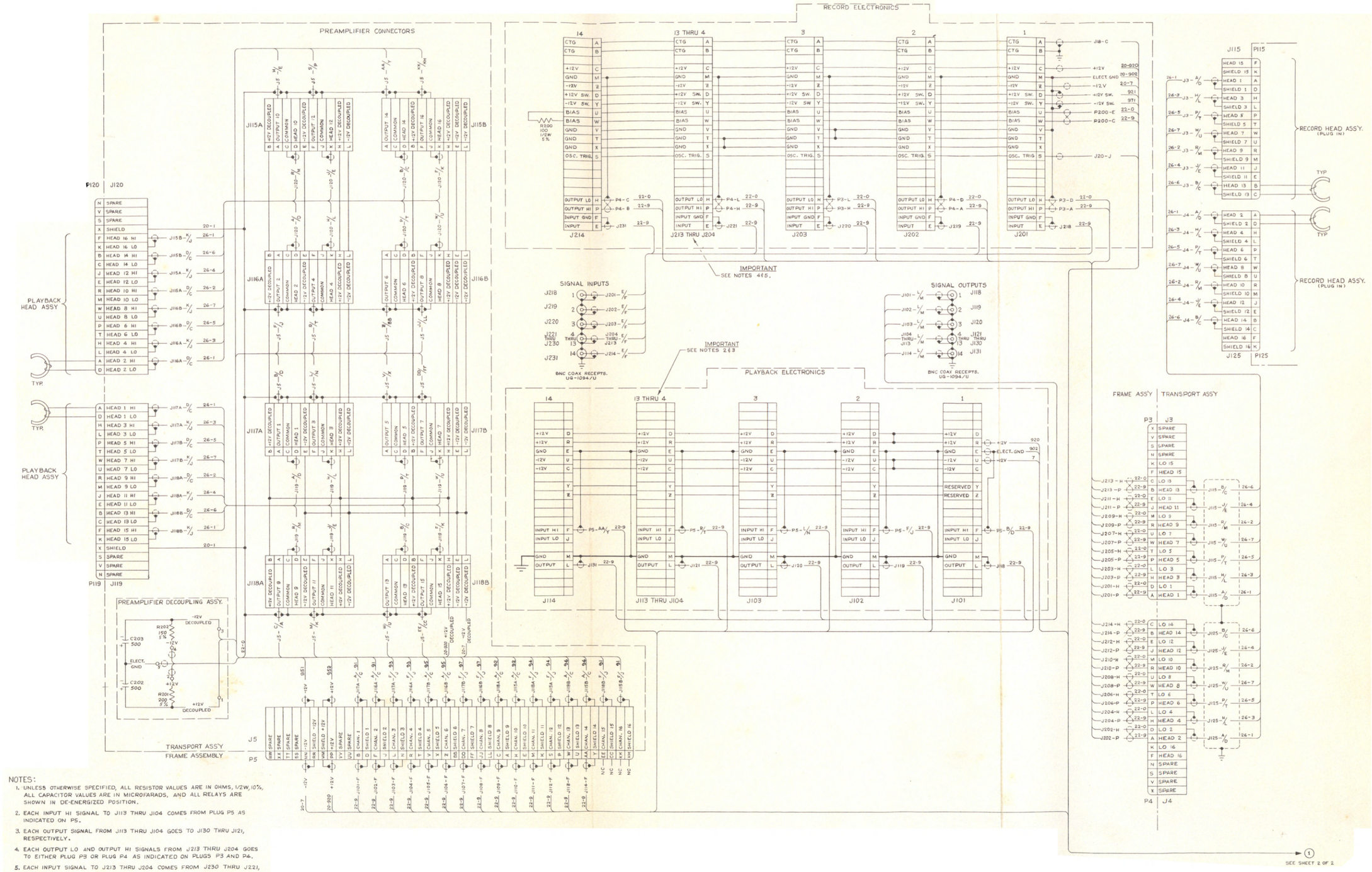
PDM RECORD AMPLIFIER CARD				CATALOG NO. 1810251-01	Sheet 1 of 2								
ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION								
					01								
1	1220985-10			PRINTED WIRING BOARD	1								
2	1220986-10			PANEL, Front	1								
3	46417-1			INSULATOR, Shield	1								
4	46325-1			SHIELD	1								
5	1220158-20			SHORTING PLUG	1								
6	030-095			CAPACITOR, Fixed, Ceramic, .1 μf, ±20% tol., 25 v	3								
7	030-223			CAPACITOR, Fixed, Ceramic, 2.2 μf, ±20% tol., 25 v	1								
8	037-079			CAPACITOR, Fixed, Tantalum, 4.7 μf, ±20% tol., 25 v	2								
9	037-080			CAPACITOR, Fixed, Tantalum, 10 μf, ±20% tol., 25 v	2								
10	037-068			CAPACITOR, Fixed, Tantalum, 15 μf, ±20% tol., 20 v	3								
11	034-181			CAPACITOR, Fixed, Mica, 47 pf, ±5% tol., 500 v	2								
12	034-213			CAPACITOR, Fixed, Mica, 150 pf, ±5% tol., 500 v	2								
13	034-695	DM-20F-681F		CAPACITOR, Fixed, Mica, 680 pf, ±1% tol., 500 v	1								
14	034-957			CAPACITOR, Fixed, Mica, 820 pf, ±5% tol., 500 v	1								
15	013-201	1N914	CR1 thru CR8	DIODE, Silicon	8								
16	540-015			INDUCTOR, 1 mh, ±5%, 1/3 watt	2								
17	041-496			RESISTOR, Fixed, 10 ohms, ±5% tol., 1/4 watt	1								
18	041-739			RESISTOR, Fixed, 180 ohms, ±5% tol., 1/4 watt	5								
19	041-742			RESISTOR, Fixed, 360 ohms, ±5% tol., 1/4 watt	2								
20	044-388			RESISTOR, Variable, 500 ohms, 1/2 watt	1								
21	041-440			RESISTOR, Fixed, 1200 ohms, ±5% tol., 1/4 watt	2								
22	041-560			RESISTOR, Fixed, 2000 ohms, ±5% tol., 1/4 watt	1								
23	041-414			RESISTOR, Fixed, 2200 ohms, ±5% tol., 1/4 watt	2								
24	041-407			RESISTOR, Fixed, 3300 ohms, ±5% tol., 1/4 watt	4								
25	041-412			RESISTOR, Fixed, 4700 ohms, ±5% tol., 1/4 watt	3								
26	041-495			RESISTOR, Fixed, 8200 ohms, ±5% tol., 1/4 watt	2								
27	042-238			RESISTOR, Fixed, 10K ohms, ±1% tol., 1/2 watt	1								

PDM RECORD AMPLIFIER CARD				CATALOG NO. 1810251-01	Sheet 2 of 2									
ITEM NO.	AMPEX PART NO.	VENDOR OR MIL. NO.	SCHEMATIC REFERENCE	PART DESCRIPTION	QUANTITY REQUIRED PER VERSION									
					01									
28	041-508			RESISTOR, Fixed, 20K ohms, ±5% tol., 1/4 watt	2									
29	041-411			RESISTOR, Fixed, 47K ohms, ±5% tol., 1/4 watt	4									
30	041-572			RESISTOR, Fixed, 51K ohms, ±5% tol., 1/4 watt	2									
31	041-573			RESISTOR, Fixed, 75K ohms, ±5% tol., 1/4 watt	2									
32	044-243			RESISTOR, Variable, 100K ohms, 1/4 watt	1									
33	014-117	2N706	Q8, Q9	TRANSISTOR, Silicon	2									
34	014-245	2N861	Q2, Q14	TRANSISTOR, Silicon	2									
35	014-247	SM1161	Q1,Q3-Q7,Q10-Q13	TRANSISTOR, Silicon	10									
36	280-047			SPACER, Transistor	4									
37	150-103			SOCKET, Transistor	14									
38	148-039			JACK, Test Point, Black	1									
39	148-042			JACK, Test Point, White	1									
40	460-013			RIVET, Oval Head, .060 Dia. x .187 Lg.	2									
41	471-055			SCREW, Machine, #2-56 x 5/16 Lg., Pan Head, Slotted Drive, Steel, Cad. Plate	2									
42	471-838			SCREW, Machine, #2-56 x 3/16 Lg., Pan Head, Slotted Drive, Steel, Cad. Plate	3									
43	502-001			WASHER, Spring Lock, #2, Steel, Cad. Plate	5									
46	49260-10			PLATE, Identification, Serial No.	1									
47	148-065			JACK, Test, Yellow	3									
48	148-038			JACK, Test Point, Red	1									
49	042-248			RESISTOR, Fixed, 10 ohms, ±1% tol., 1/2 watt	1									
50	041-408			RESISTOR, Fixed, 10K ohms, ±5% tol., 1/4 watt	1									
51	044-347			RESISTOR, Variable, 10K ohms, 1/8 watt	1									

CHANGED 15 AUGUST 1964

CHAPTER EIGHT
SCHEMATIC DIAGRAMS

Table of Contents



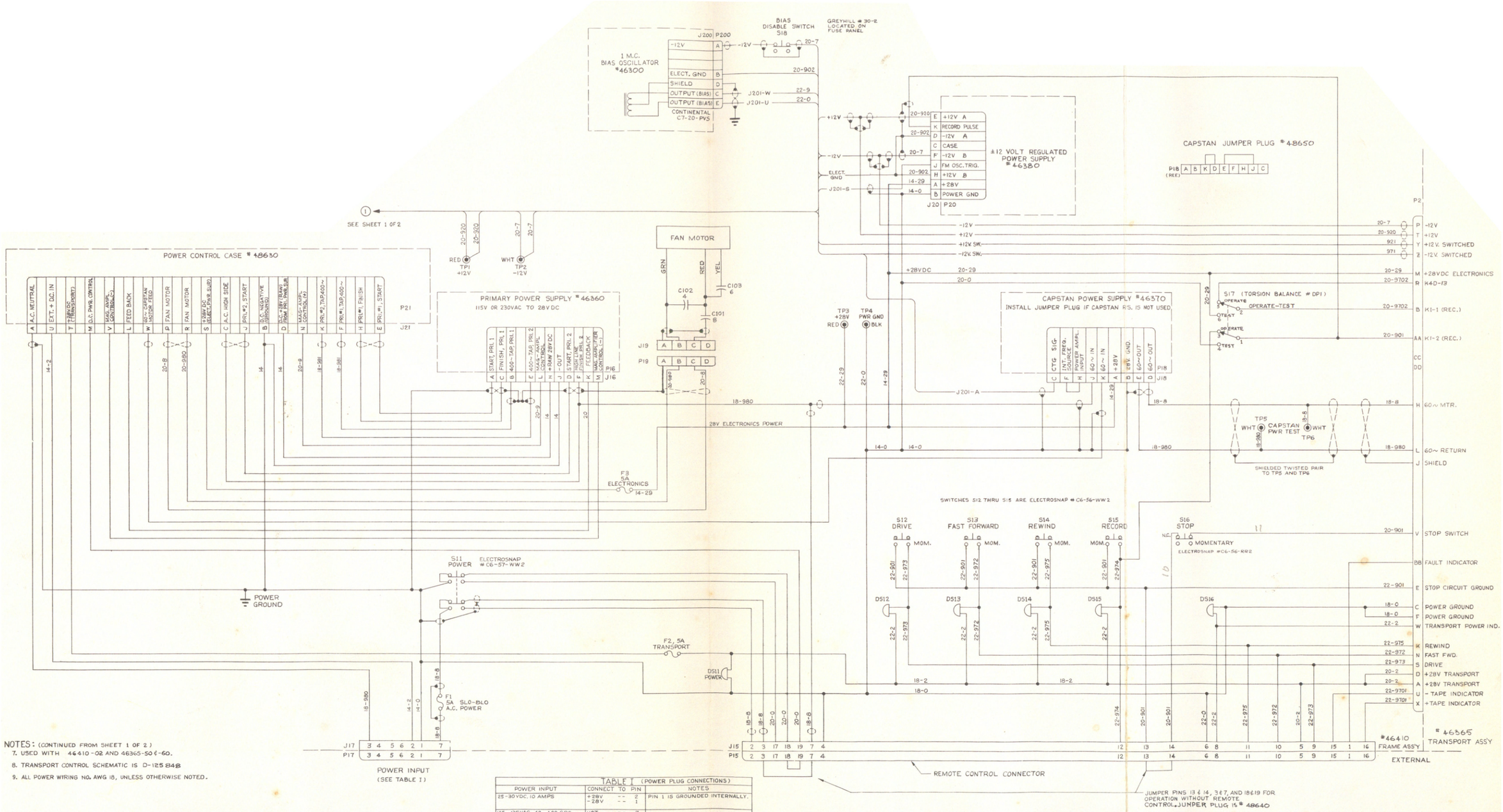
NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 10%, ALL CAPACITOR VALUES ARE IN MICROFARADS, AND ALL RELAYS ARE SHOWN IN DE-ENERGIZED POSITION.
2. EACH INPUT HI SIGNAL TO J113 THRU J104 COMES FROM PLUG P5 AS INDICATED ON P5.
3. EACH OUTPUT SIGNAL FROM J113 THRU J104 GOES TO J130 THRU J121, RESPECTIVELY.
4. EACH OUTPUT LO AND OUTPUT HI SIGNALS FROM J213 THRU J204 GOES TO EITHER PLUG P3 OR PLUG P4 AS INDICATED ON PLUGS P3 AND P4.
5. EACH INPUT SIGNAL TO J213 THRU J204 COMES FROM J230 THRU J221, RESPECTIVELY.

NOTES CONTINUED ON SHEET 2 OF 2.

Figure 8-1 CP-100 Schematic Wiring Diagram, Recorder-Reproducer

46268G
1 of 2



NOTES: (CONTINUED FROM SHEET 1 OF 2.)

7. USED WITH 46410-02 AND 46365-50 & -60.
8. TRANSPORT CONTROL SCHEMATIC IS D-125 848
9. ALL POWER WIRING NO. AWG 18, UNLESS OTHERWISE NOTED.

TABLE I (POWER PLUG CONNECTIONS)

POWER INPUT	CONNECT TO	PIN	NOTES
25-30 VDC, 10 AMPS	+28V	2	PIN 1 IS GROUNDED INTERNALLY.
	-28V	1	
105-125 VAC, 48-400 CPS	HOT	7	
	NEUT.	8	
	GND	1	
105-125 VAC, 60 CPS ± 0.1%	HOT	7	IF NO MDA IS USED INSTALL CAPSTAN INVERTER PLUG.
	NEUT.	8	
	GND	1	
210-250 VAC, 48-400 CPS	HOT	7	
	NEUT.	3	
	GND	1	
210-250 VAC, 60 CPS ± 0.1%	HOT	7	IF NO MDA IS USED INSTALL CAPSTAN INVERTER PLUG.
	NEUT.	3	
	GND	1	

Figure 8-2 CP-100 Schematic Wiring Diagram, Recorder-Reproducer

46360 2 of 2

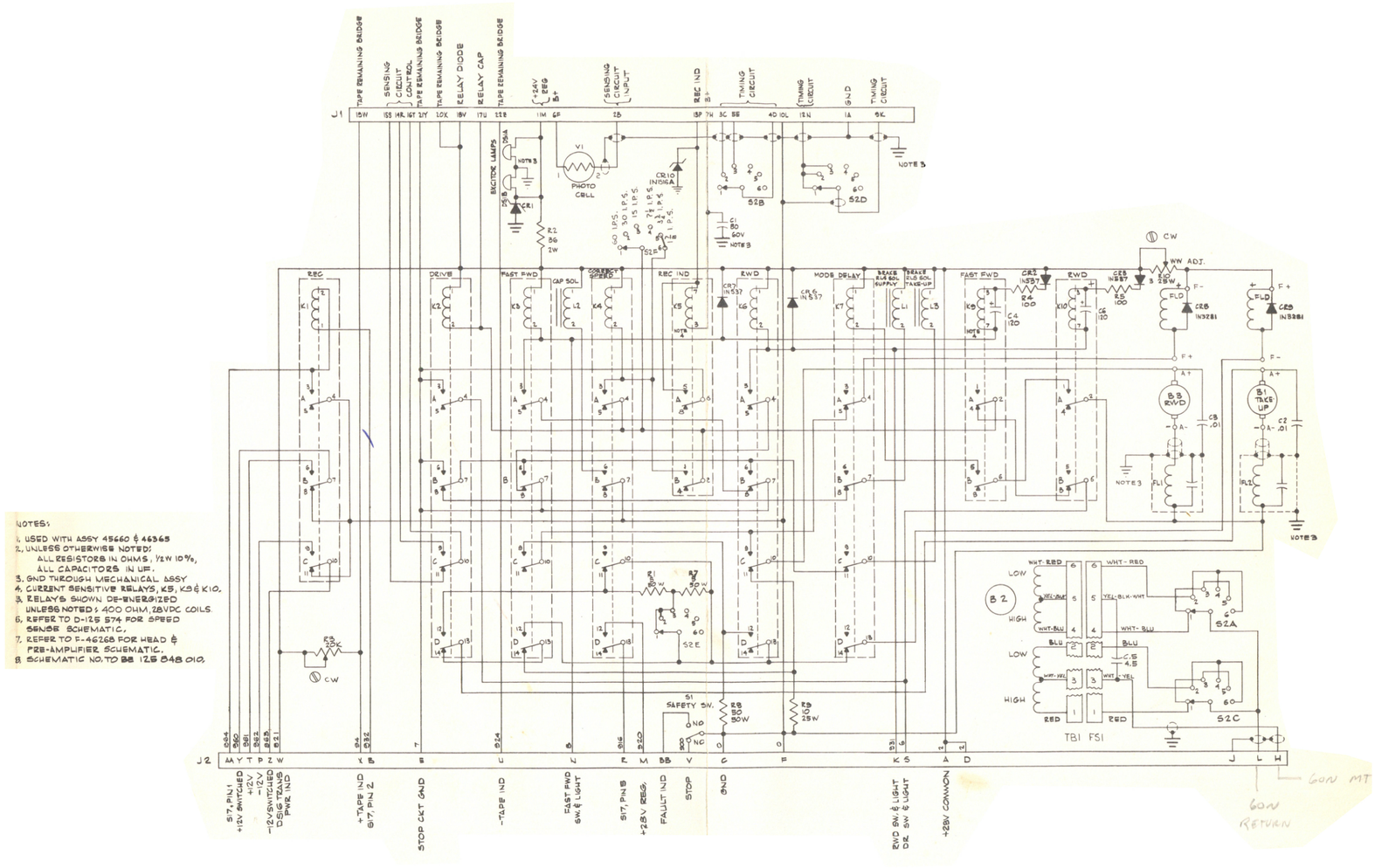
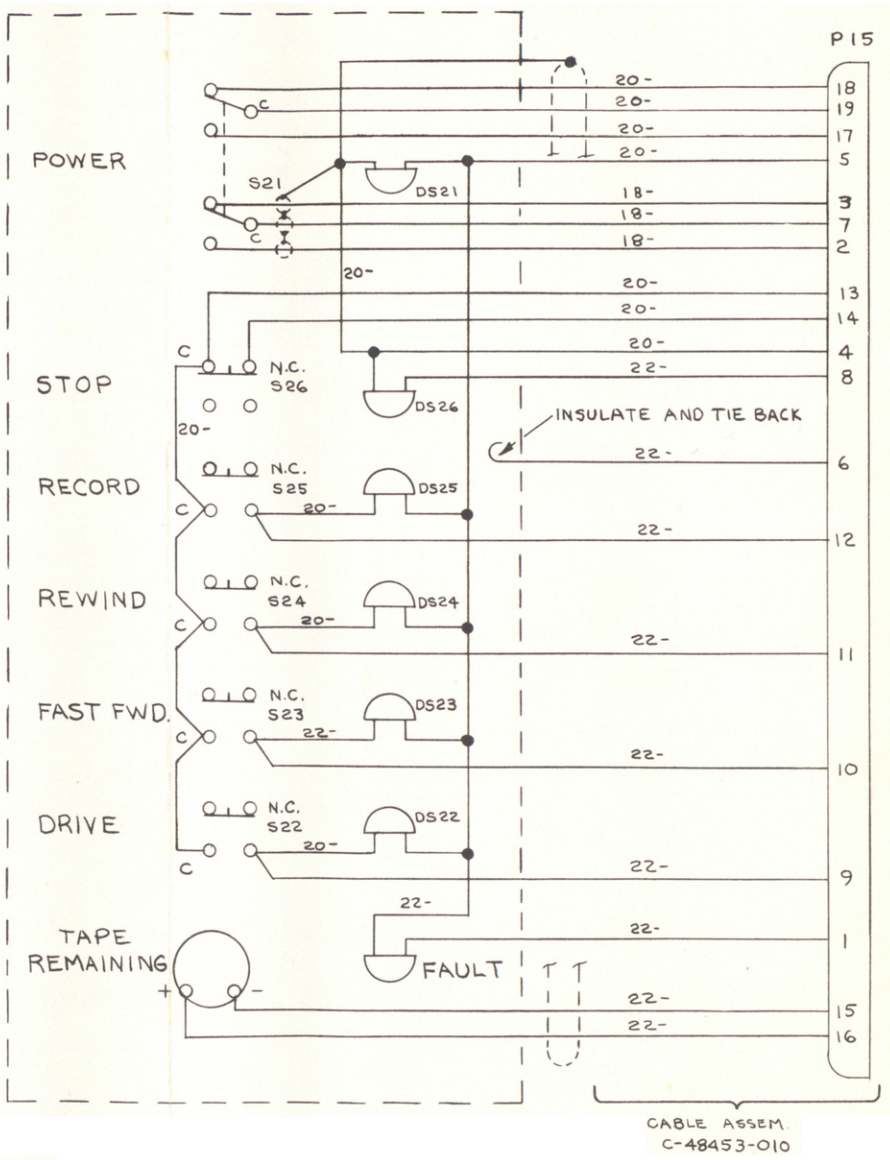


Figure 8-3 CP-100 Schematic Diagram, Transport Control Circuits

125848C



NOTES.

1. USE WITH ASSY D48460-010.

Figure 8-4 **CP-100 Schematic Diagram, Remote Control Unit**

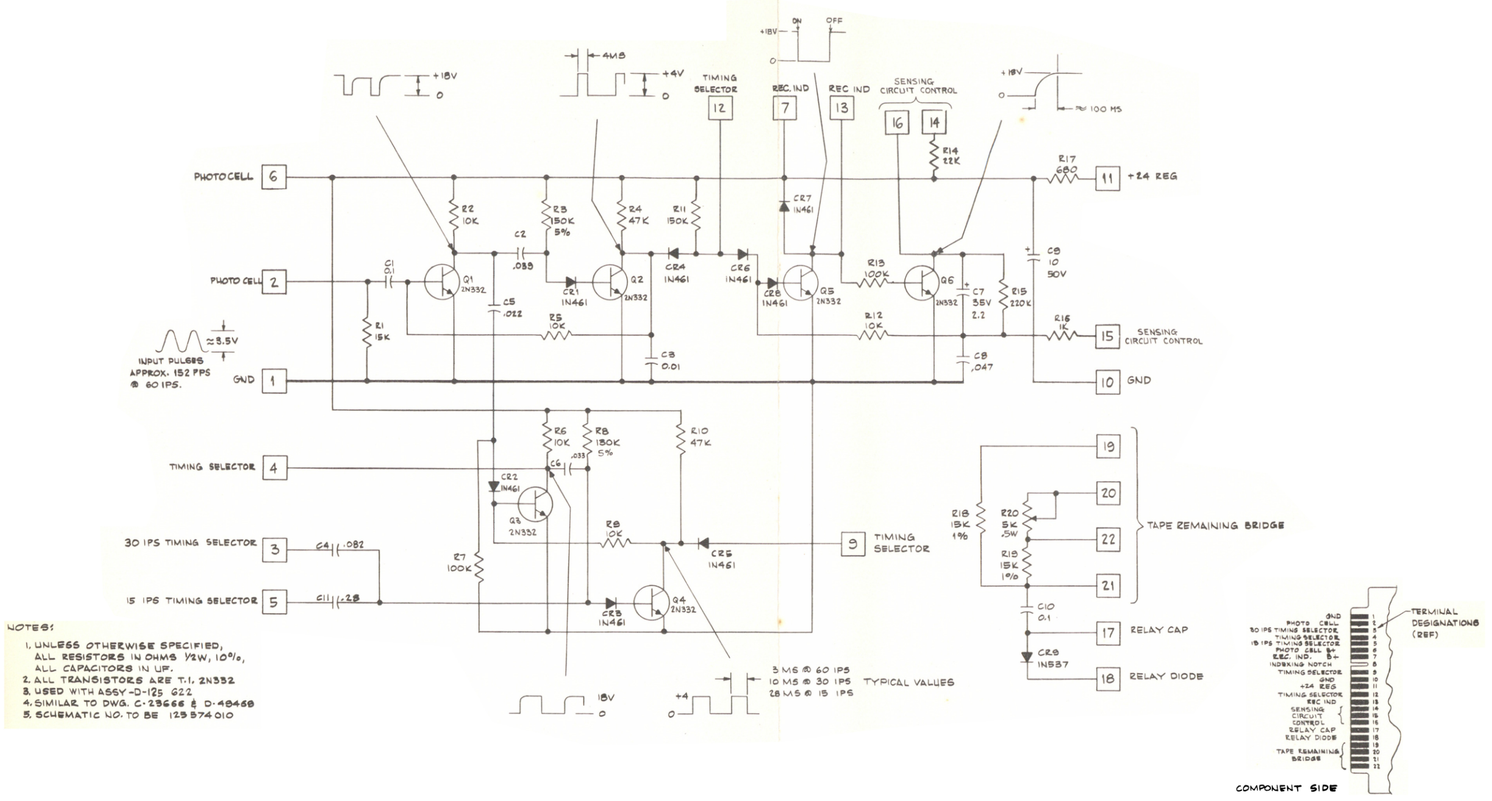
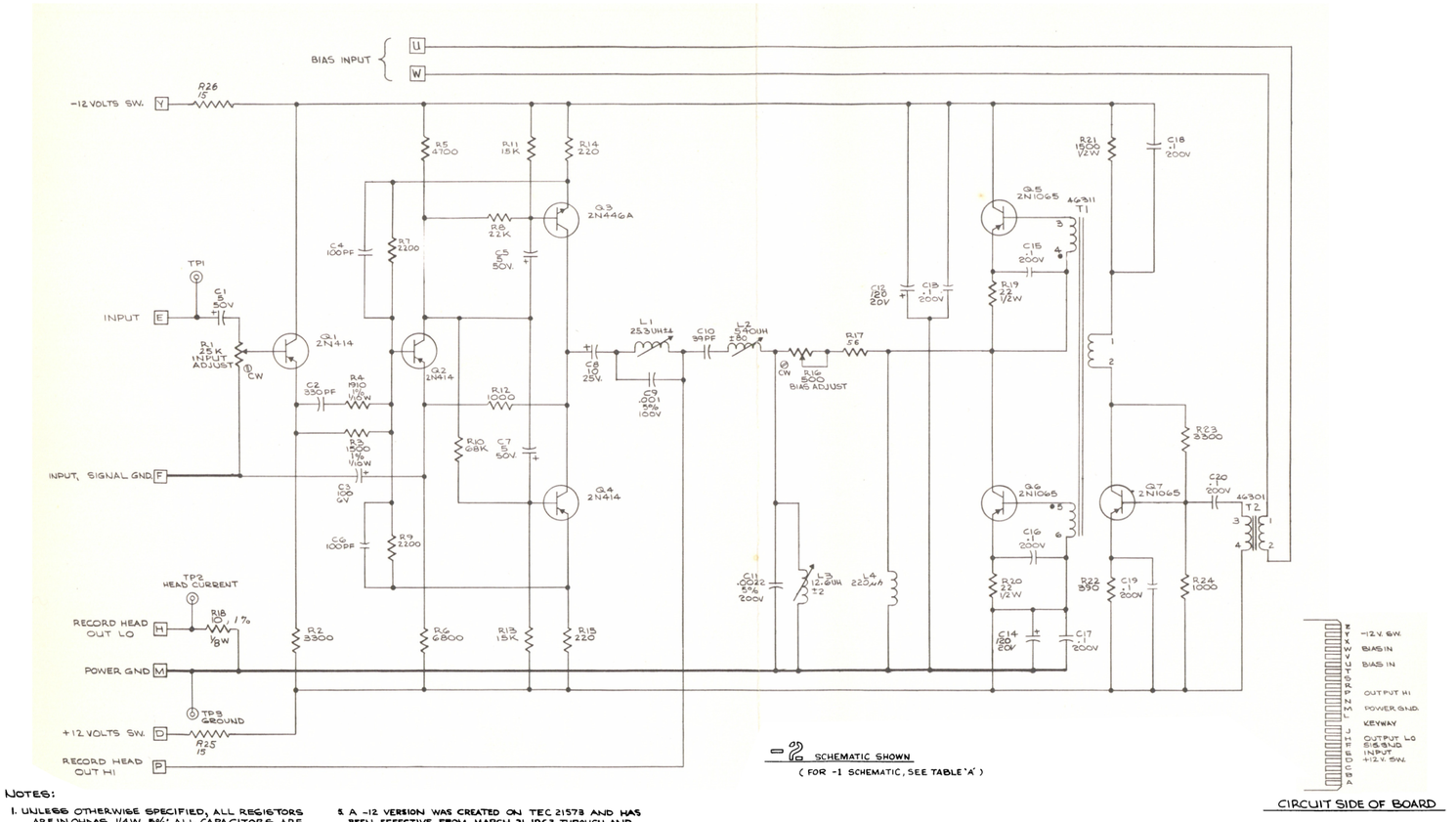


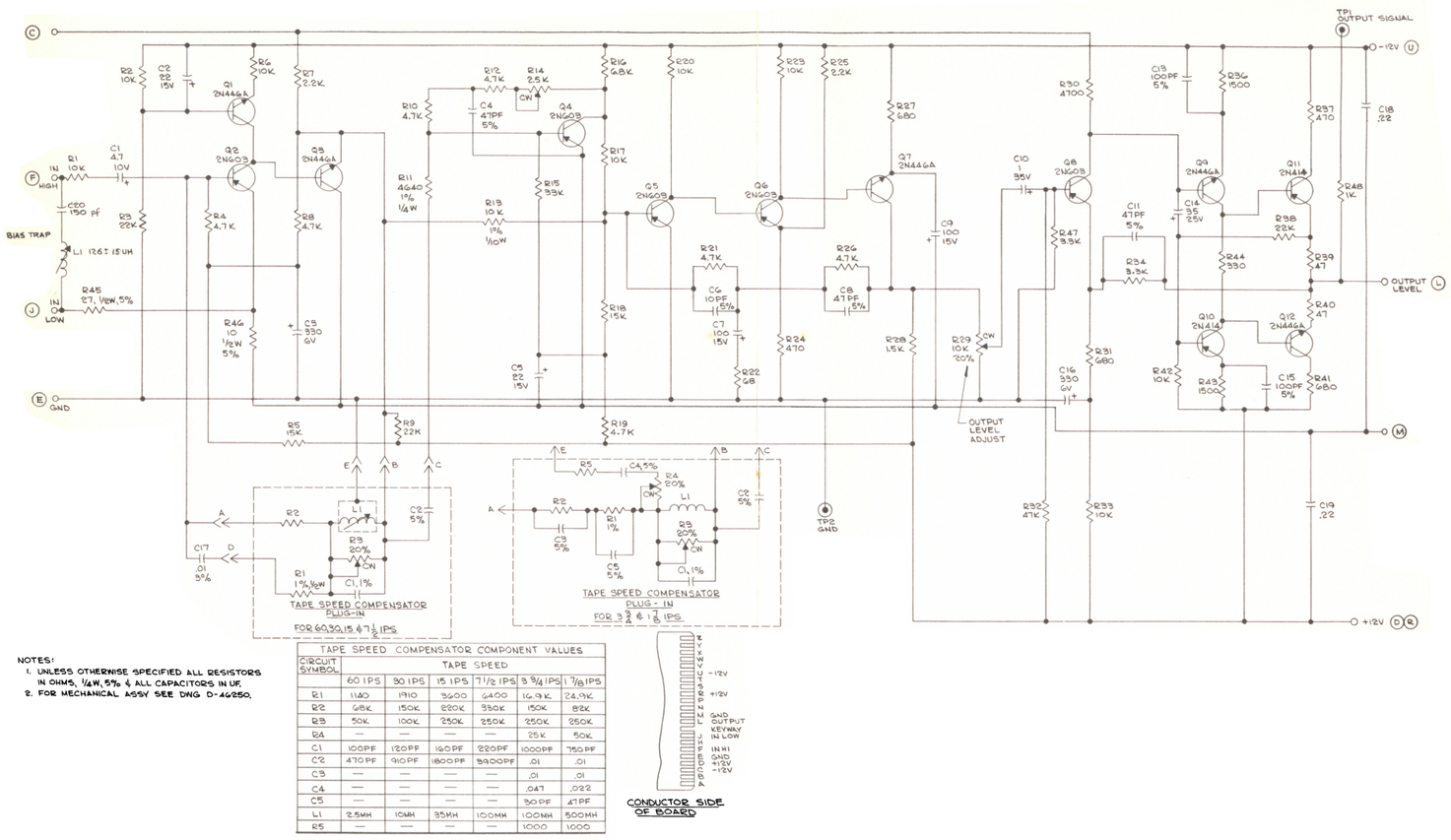
Figure 8-5 CP-100 Schematic Diagram, Speed Sensing Circuit



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/4W, 5%; ALL CAPACITORS ARE IN MICROFARADS.
2. USED WITH MECHANICAL ASSY PER TABLE 'A'.
3. CAPACITORS SHOWN IN PF ARE MICA, 5%, 500V.
4. SCHEMATIC NO. TO BE PER TABLE 'A'.
5. A -12 VERSION WAS CREATED ON TEC 21578 AND WAS BEEN EFFECTIVE FROM MARCH 21, 1962 THROUGH AND INCLUDING JULY 1962. C12 & C14 WERE 68 UF, R25 & R26 WERE 33 OHMS.

Figure 8-6 CP-100 Schematic Diagram, Direct Record Amplifier

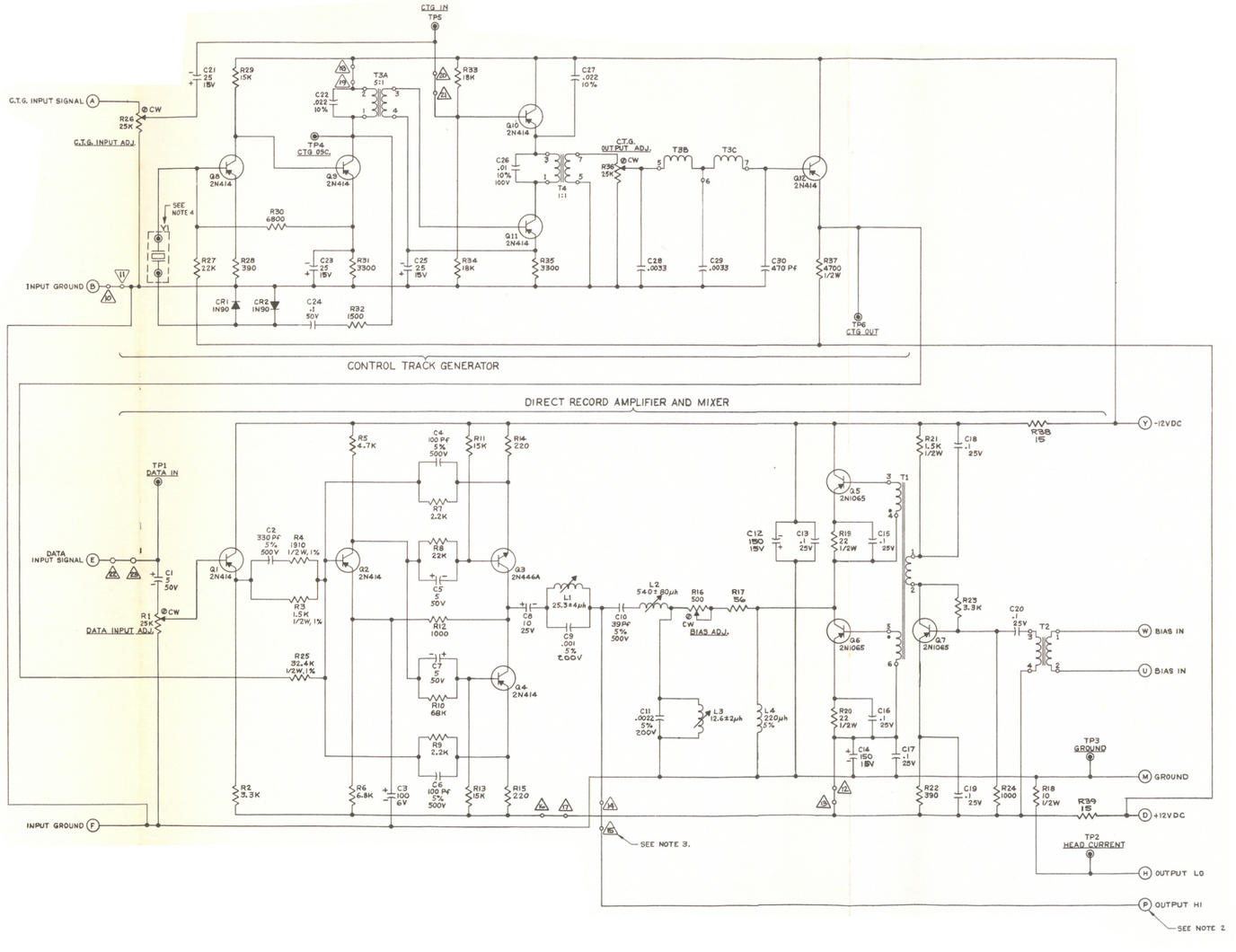


NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS IN OHMS, ¼W, 5% & ALL CAPACITORS IN UF.
2. FOR MECHANICAL ASSY SEE DWG D-46250.

TAPE SPEED COMPENSATOR COMPONENT VALUES						
CIRCUIT SYMBOL	TAPE SPEED					
	60 IPS	30 IPS	15 IPS	7½ IPS	3¾ IPS	1⅞ IPS
R1	1140	1910	3600	6400	16.9K	24.9K
R2	68K	150K	220K	330K	150K	82K
R3	50K	100K	250K	250K	250K	250K
R4	—	—	—	—	25K	50K
C1	100PF	120PF	160PF	220PF	1000PF	750PF
C2	470PF	910PF	1800PF	3900PF	.01	.01
C3	—	—	—	—	.01	.01
C4	—	—	—	—	.047	.022
C5	—	—	—	—	30PF	47PF
L1	2.5MH	10MH	35MH	100MH	100MH	500MH
R5	—	—	—	—	1000	1000

Figure 8-7 CP-100 Schematic Diagram, Direct Reproduce Amplifier

46253F



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%, AND ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. LETTERS INCASED IN CIRCLES ◯ DENOTE PRINTED CIRCUIT BOARD TERMINAL LETTERS.
3. NUMBERS INCASED IN TRIANGLES △ DENOTE JUMPER CONNECTION POINTS ON PRINTED CIRCUIT BOARD.
4. TWO OSCILLATOR FREQUENCIES ARE AVAILABLE, 17KC AND 18.24 KC., SEE DWG D-46000 FOR CRYSTAL PART NUMBERS.
5. USED WITH ASSY., 46570-30
6. SCHEMATIC NO. TO BE 126 699 010.

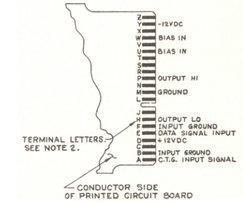
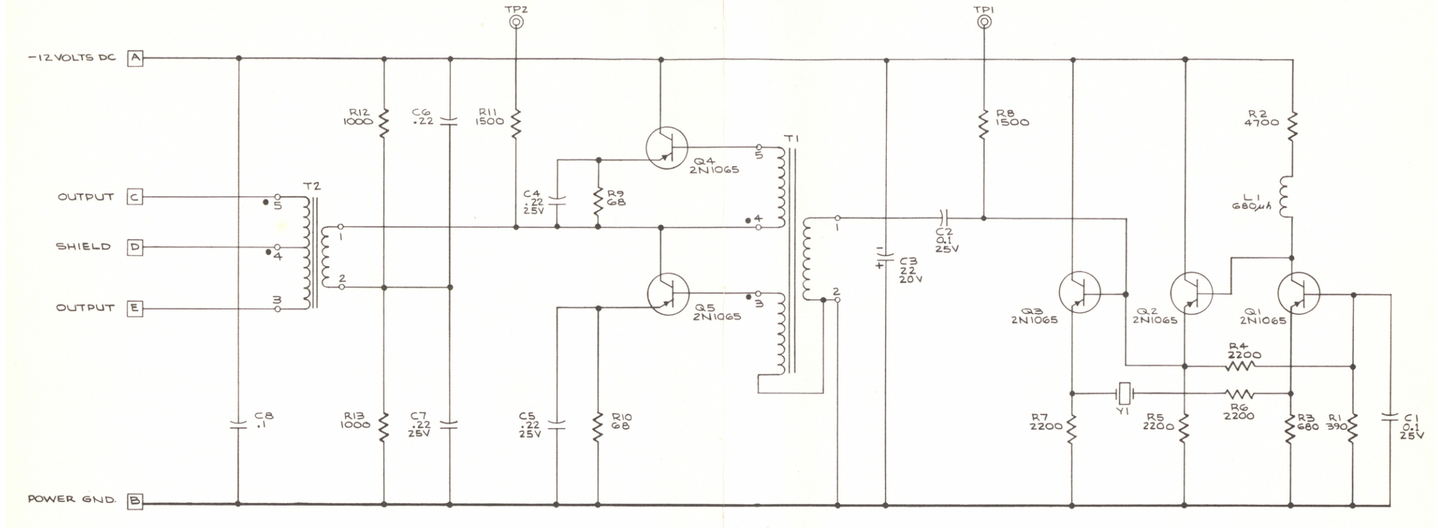


Figure 8-8 **CP-100 Schematic Diagram, Control Track Generator**

126699A

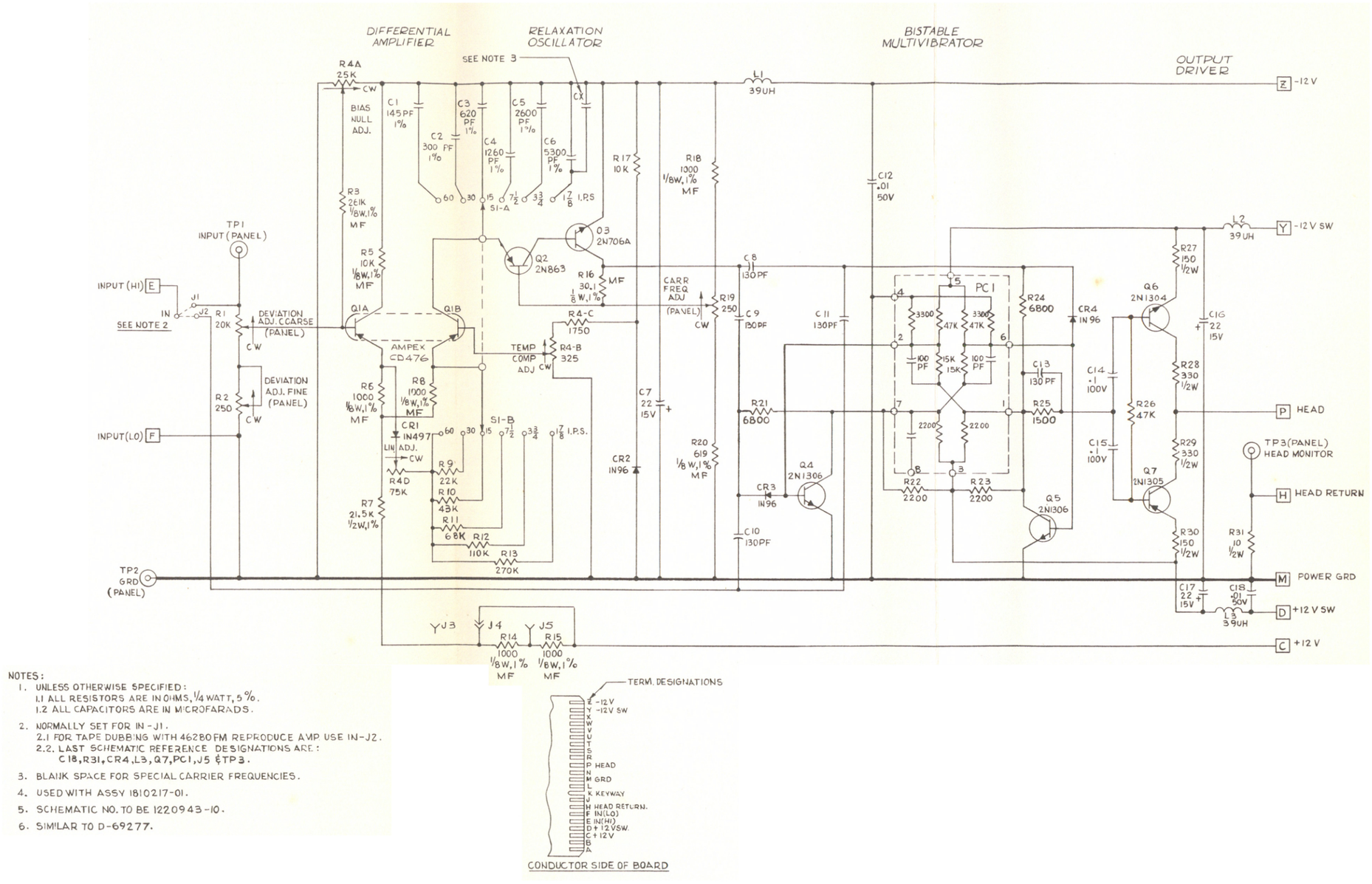


NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE IN OHMS, 1/2 W, 5%; ALL CAPACITORS ARE IN MICROFARADS.
2. LETTERS IN SQUARES "□" DENOTE CONNECTOR PINS.
3. FOR BOARD ASS'Y SEE C-46310-10.

Figure 8-9 CP-100 Schematic Diagram, Master Bias Oscillator

46257A

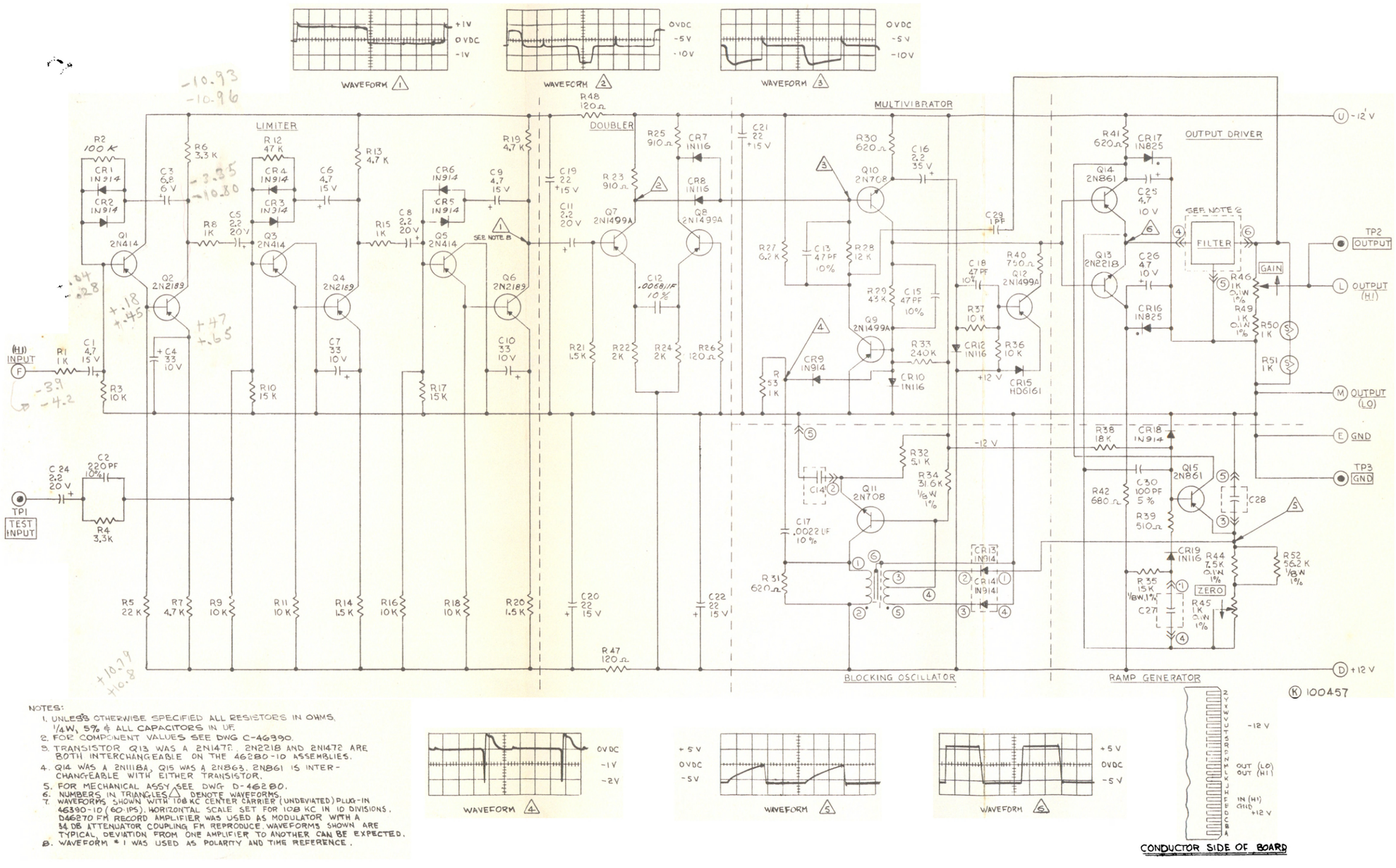


NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   1.1 ALL RESISTORS ARE IN OHMS, 1/4 WATT, 5%.
   1.2 ALL CAPACITORS ARE IN MICROFARADS.
2. NORMALLY SET FOR IN-J1.
   2.1 FOR TAPE DUBBING WITH 4628 OFM REPRODUCE AMP USE IN-J2.
   2.2. LAST SCHEMATIC REFERENCE DESIGNATIONS ARE: C18, R31, CR4, L3, Q7, PC1, J5 & TP3.
3. BLANK SPACE FOR SPECIAL CARRIER FREQUENCIES.
4. USED WITH ASSY 1810217-01.
5. SCHEMATIC NO. TO BE 1220943-10.
6. SIMILAR TO D-69277.

Figure 8-10 CP-100 Schematic Diagram, FM Record Amplifier 1220943B

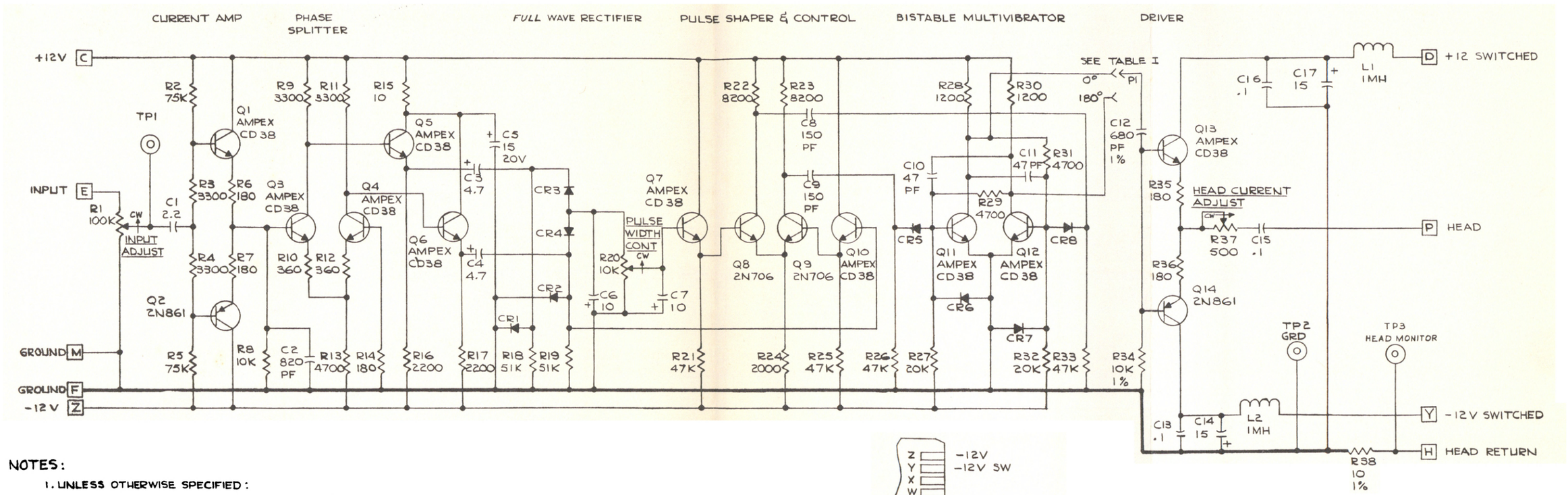
CHANGED 15 AUGUST 1964



NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS IN OHMS, 1/4W, 5% & ALL CAPACITORS IN UF.
2. FOR COMPONENT VALUES SEE DWG C-46390.
3. TRANSISTOR Q13 WAS A 2N1472. 2N2218 AND 2N1472 ARE BOTH INTERCHANGEABLE ON THE 46280-10 ASSEMBLIES.
4. Q14 WAS A 2N1118A, Q15 WAS A 2N863. 2N861 IS INTERCHANGEABLE WITH EITHER TRANSISTOR.
5. FOR MECHANICAL ASSY SEE DWG D-46280.
6. NUMBERS IN TRIANGLES △ DENOTE WAVEFORMS.
7. WAVEFORMS SHOWN WITH 108 KC CENTER CARRIER (UNDEVIATED) PLUG-IN 46390-10 (60 IPS). HORIZONTAL SCALE SET FOR 108 KC IN 10 DIVISIONS. D46270 FM RECORD AMPLIFIER WAS USED AS MODULATOR WITH A 34 DB ATTENUATOR COUPLING FM REPRODUCE. WAVEFORMS SHOWN ARE TYPICAL, DEVIATION FROM ONE AMPLIFIER TO ANOTHER CAN BE EXPECTED.
8. WAVEFORM #1 WAS USED AS POLARITY AND TIME REFERENCE.

Figure 8-11 CP-100 Schematic Diagram, FM Reproduce Amplifier 46256D



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   - 1.1. ALL RESISTORS ARE IN OHMS, ¼W, 5%.
   - 1.2. ALL CAPACITORS ARE IN MICROFARADS.
   - 1.3. ALL DIODES ARE IN914.
2. USED WITH DWG D-1810251.
3. SCHEMATIC NO. TO BE 1220983-10.

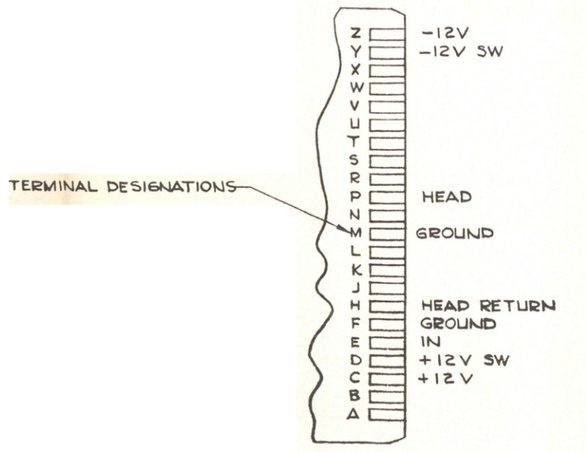
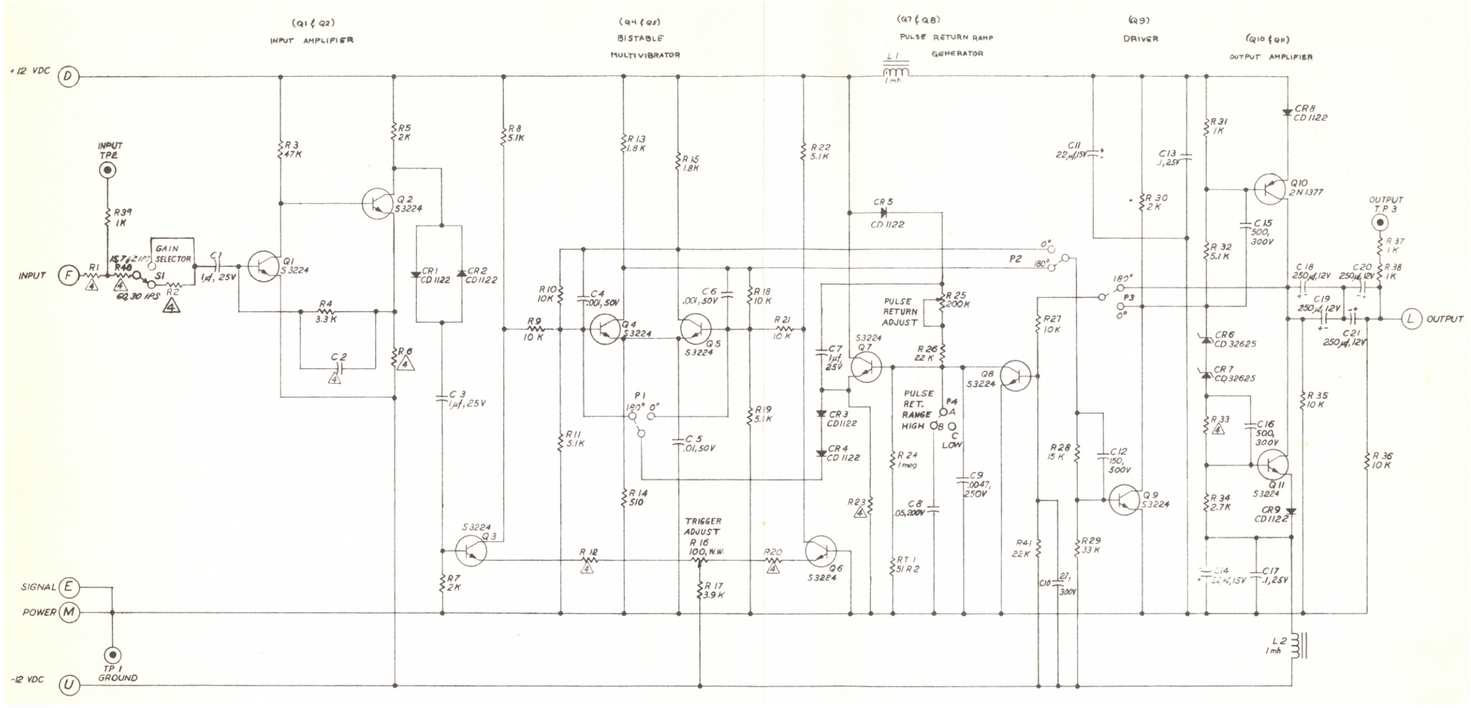


Figure 8-12. CP-100 Schematic Diagram, PDM Record Amplifier 1220983

CHANGED 15 AUGUST 1964



POLARITY SELECTION TABLE				
INPUT	P1	P2	P3	OUTPUT
+	0°	0°	0°	+
+	0°	180°	180°	−
−	180°	180°	0°	+
−	180°	0°	180°	−

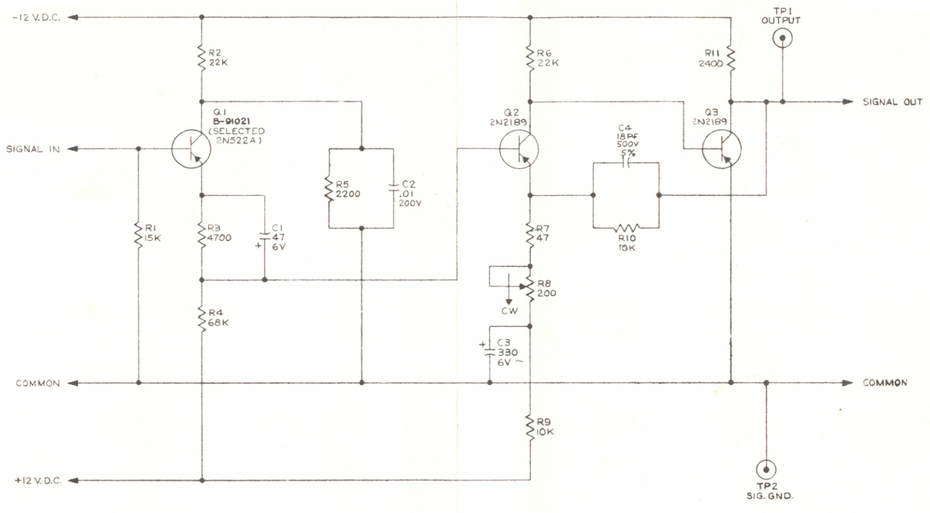
T & C COMPONENTS ⚠4	
REF. DESIG.	APPROX. VALUE
C2	500, 300V
R1	100
R2	1K
R6	100
R12	150
R20	47
R23	1.8K
R33	4.7K
R40	2K

VERSION	SCHEM. NO	USED WITH ASSY NO.
01	125851010	46420-10
02	125851020	46420-11

7. 02 VERSION SHOWN; OMIT R39 & R40 FOR 01 VERSION.
6. USED WITH ASS'Y (SEE VERSION TABLE).
5. SUBSTITUTIONS TO BE EQUAL TO & INTERCHANGEABLE WITH PRODUCTS SPECIFIED.
⚠4 COMPONENT VALUE TO BE DETERMINED AT TIME OF T & C.
3. ALL CAPACITOR VALUES LESS THAN ONE (1) ARE IN MICROFARADS & VALUES GREATER THAN ONE (1) ARE IN MICROMICROFARADS.
2. ALL RESISTORS ARE ½ WATT.
1. ALL RESISTOR VALUES ARE GIVEN IN OHMS.

NOTES: UNLESS OTHERWISE SPECIFIED.

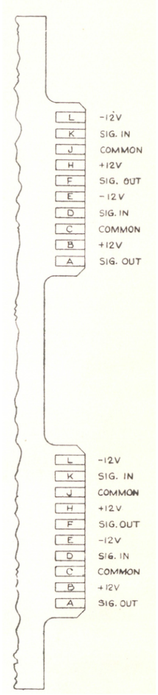
Figure 8-13 CP-100 Schematic Diagram, PDM Reproduce Amplifier



NOTES:

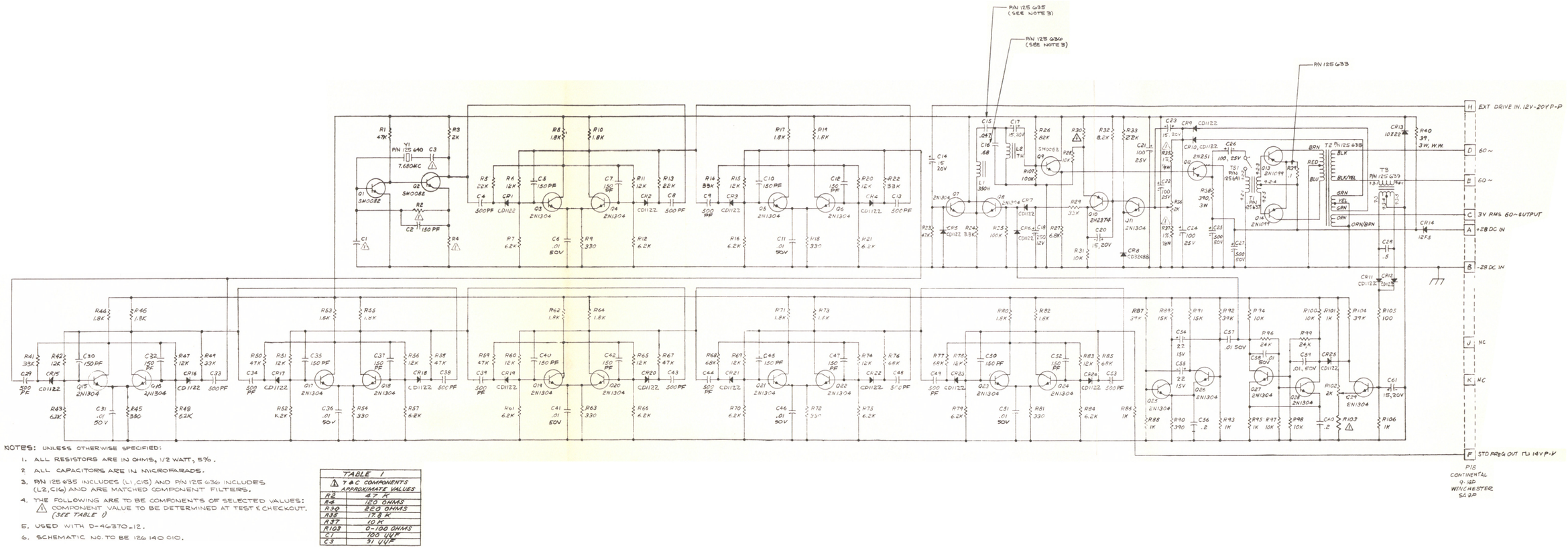
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS IN OHMS, 1/4 W, ± 5%, AND ALL CAPACITORS IN MICROFARADS.
2. CIRCUIT SYMBOL NUMBERS REFER TO LAST DIGIT(S) OF THE COMPONENT NUMBERS CALLED OUT ON CIRCUIT BOARD.
3. FOR BOARD ASS'Y SEE D-46290-30 OR D-46290-40
4. SCHEMATIC NO. TO BE 126 030 010.

TYPICAL CIRCUIT
4 PLACES FOR 46290-30
3 PLACES FOR 46290-40
(SEE NOTES 2 & 3)



CONDUCTOR SIDE OF BOARD

Figure 8-14 CP-100 Schematic Diagram, Reproduce Preamplifier



NOTES: UNLESS OTHERWISE SPECIFIED:

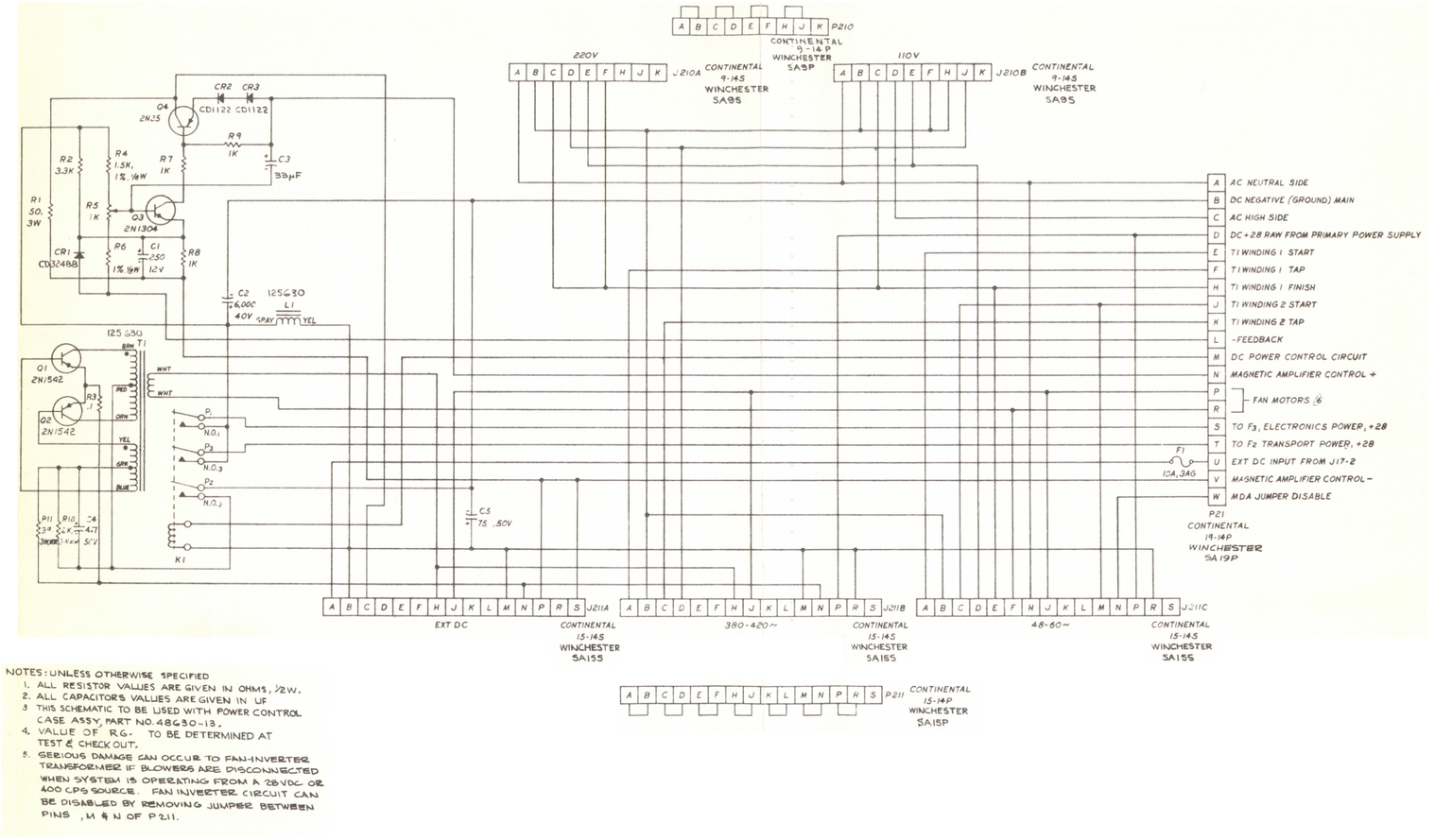
1. ALL RESISTORS ARE IN OHMS, 1/2 WATT, 5%.
2. ALL CAPACITORS ARE IN MICROFARADS.
3. P/N 125 635 INCLUDES (L1, C15) AND P/N 125 636 INCLUDES (L2, C16) AND ARE MATCHED COMPONENT FILTERS.
4. THE FOLLOWING ARE TO BE COMPONENTS OF SELECTED VALUES: ⚠ COMPONENT VALUE TO BE DETERMINED AT TEST & CHECKOUT. (SEE TABLE I)
5. USED WITH D-40370-12.
6. SCHEMATIC NO. TO BE 126 140 010.

TABLE I

⚠ T & C COMPONENTS APPROXIMATE VALUES	
R2	47 K
R4	120 OHMS
R30	220 OHMS
R35	17.8 K
R37	10 K
R103	0-100 OHMS
C1	100 UUF
C3	91 UUF

Figure 8-15 CP-100 Schematic Diagram, Capstan Drive Inverter (MDA)

126140B

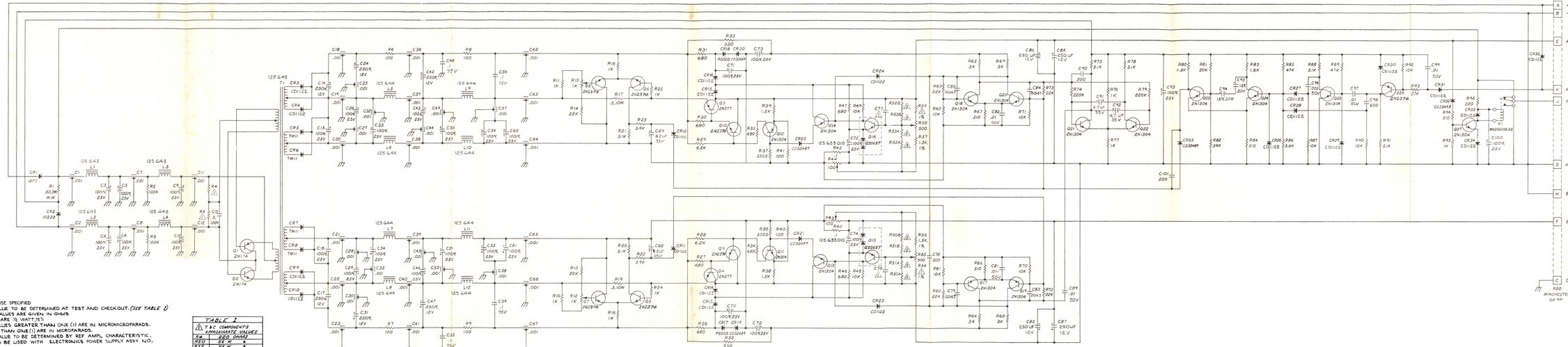


NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE GIVEN IN OHMS, ½W.
2. ALL CAPACITORS VALUES ARE GIVEN IN UF
3. THIS SCHEMATIC TO BE USED WITH POWER CONTROL CASE ASSY, PART NO. 48630-13.
4. VALUE OF R6 TO BE DETERMINED AT TEST & CHECKOUT.
5. SERIOUS DAMAGE CAN OCCUR TO FAN-INVERTER TRANSFORMER IF BLOWERS ARE DISCONNECTED WHEN SYSTEM IS OPERATING FROM A 28 VDC OR 400 CPS SOURCE. FAN INVERTER CIRCUIT CAN BE DISABLED BY REMOVING JUMPER BETWEEN PINS M & N OF P211.

Figure 8-16 CP-100 Schematic Diagram, Power Control Case

126041A



NOTES: UNLESS OTHERWISE SPECIFIED

1. ⚠ COMPONENT VALUE TO BE DETERMINED AT TEST AND CHECKOUT. *(SEE TABLE I)*
2. ALL RESISTOR VALUES ARE GIVEN IN OHMS
3. ALL RESISTORS ARE ½ WATT, ±5%
4. CAPACITOR VALUES GREATER THAN ONE (1) ARE IN MICROMICROFARADS. E VALUES LESS THAN ONE (1) ARE IN MICROFARADS.
5. ⚠ COMPONENT VALUE TO BE DETERMINED BY REF AMPL CHARACTERISTIC.
6. THIS SCHEM TO BE USED WITH ELECTRONICS POWER SUPPLY ASSY NO. D-AG380-13.
7. SCHEM NO TO BE 126 042 010.

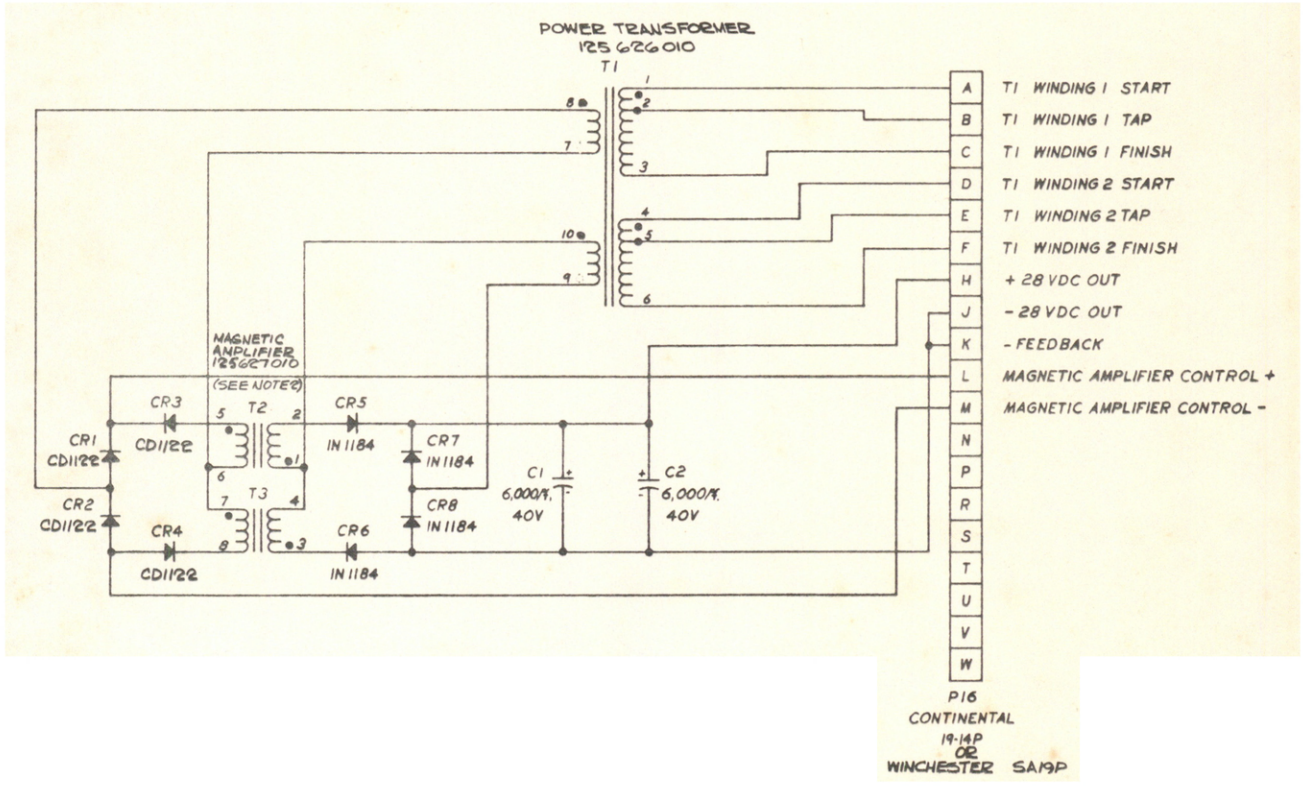
TABLE I

⚠ T&C COMPONENTS APPROXIMATE VALUES	
R4	220 OHMS
R20	68 K *
R33	56 K *
R54	300 OHMS
R69	300 OHMS
C74	.001 UF/150V
C79	.001 UF/250V
R5	1 K

* A SIDE OR B SIDE DETERMINED AT TIME OF CHECKOUT.

Figure 8-17 CP-100 Schematic Diagram, Electronics Power Supply

126428



NOTES:

1. THIS SCHEMATIC TO BE USED WITH THE PRIMARY POWER SUPPLY PART NO. 46360-12.
2. T2 & T3 TOGETHER MAKE UP THE MAGNETIC AMPLIFIER 125627010.
3. SCHEMATIC NO. TO BE 126043 010.

Figure 8-18 CP-100 Schematic Diagram, Primary Power Supply 126043A

SUPPLEMENT A
RACK MOUNTING ADAPTOR KIT
Ampex Catalog Number 126021-02

SA-1. RACK MOUNTING ADAPTOR KIT (Figure 1)

The rack mounting adaptor kit, catalog number 126021-02, is required whenever the CP-100 Recorder/Reproducer is mounted vertically in a standard rack assembly. The adaptor components are mounted on the transport frame to provide the necessary counter balance and safety stops for supporting the transport in the lowered position. In addition, the adaptor components also provide cooling air for the system electronics.

The adaptor kit consists of a fan and drum bracket assembly, a sheave assembly, two filler panels, and associated mounting hardware. Housed within the fan and drum assembly are a cooling fan, three fan motor capacitors, a support cable, a spring supported drum, and two safety stops. The safety stops are located on the inner-surface of the drum assembly and are drawn together when the transport is lowered.

SA-2. INSTALLATION PROCEDURES

The components in the rack mounting adaptor kit must be installed before the recorder/reproducer can be rack mounted. The following installation procedures describe both the installation of these components and the mounting of a recorder/reproducer in a standard rack.

SA-2.1 Installing the Adaptor Components:

The components in the rack mounting adaptor kit are installed on the transport and transport frame in the following manner:

NOTE

The following installation procedures need not be performed if the components in the adaptor kit have been installed at the factory.

Step 1: Refer to figure 2 and mount the sheave assembly on the rear side of the transport frame, adjacent to connector J104 on the reproduce amplifier card file. Secure the assembly using the hardware supplied with the adaptor kit.

Step 2: Refer to figure 2 and mount the fan and bracket assembly on the top end of the transport frame, directly behind the test panel. Secure the assembly in four places using the hardware supplied with the adaptor kit.

Step 3: Wind the support cable on the drum approximately four turns and insert the cable through the sheave assembly as shown in figure 2 and fasten the end of the cable to the transport chassis.

Step 4: Check the drum for at least 1/4 wrap of cable when the transport is in lowered position. If necessary, loosen the drum hold-down bolt and rotate the bolt clockwise until the correct amount of wrap is obtained.

SA-2.2 Rack Mounting the CP-100 Recorder/Reproducer:

The recorder/reproducer is rack-mounted in the following manner:

NOTE

The transport must be fastened to the frame in the closed position before installation procedures are begun.

Step 1: Mount the CP-100 in the rack leaving a space of 1-1/8 inches at the top of the frame, and 1/2 inch at the bottom of the frame for the filler panels. (See figure 3.)

Step 2: Secure the frame assembly to the rack, using six 82° flat head screws for the card file side of the frame and six binding head screws for the opposite side.

Step 3: Refer to figure 3 and install the two filler panels supplied with the adaptor kit. The 1-inch panel is mounted at the top end of the frame and the 1/2-inch panel is mounted at the bottom end of the frame.

CAUTION

EXTREME CARE SHOULD BE TAKEN WHEN LOWERING THE TRANSPORT AFTER INSTALLATION. IF THE RACK HAS NOT BEEN BOLTED TO THE FLOOR, THE ENTIRE UNIT COULD BECOME UNBALANCED AND TOPPLE WHEN THE TRANSPORT IS LOWERED.

Step 4: Lower the transport and test the assembly by gently bottoming the transport against the stops. Insure that the stop action is firm and that the cable does not slip on the drum.

NOTE

When lowered, the transport is at a 90° angle to the frame and extends out from the rack approximately 25-3/4 inches.

The power and input connections for the rack-mounted unit are located on the bottom end of the frame assembly and are identical to those of a portable unit. The power cable for the fan motor is connected to J19 on the frame assembly.

SA-3 DISASSEMBLY OF RACK MOUNT ADAPTOR

The components of the adaptor kit must be removed from the transport and transport frame if the recorder/reproducer is installed in a portable case. The procedures for disassembling the adaptor are the reverse of the adaptor installation procedures.

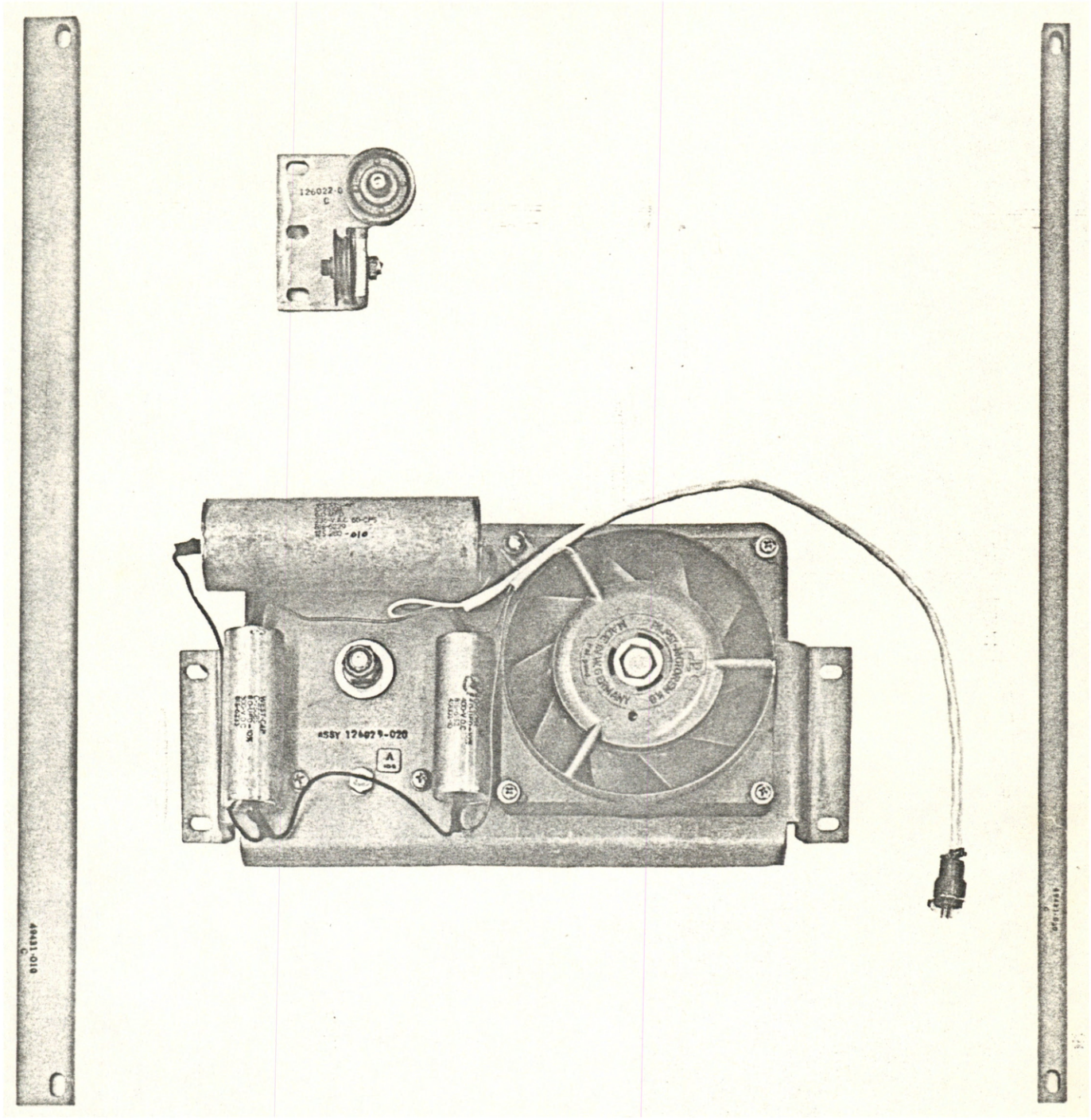


Figure 1. CP-100 RACK MOUNT ADAPTOR KIT

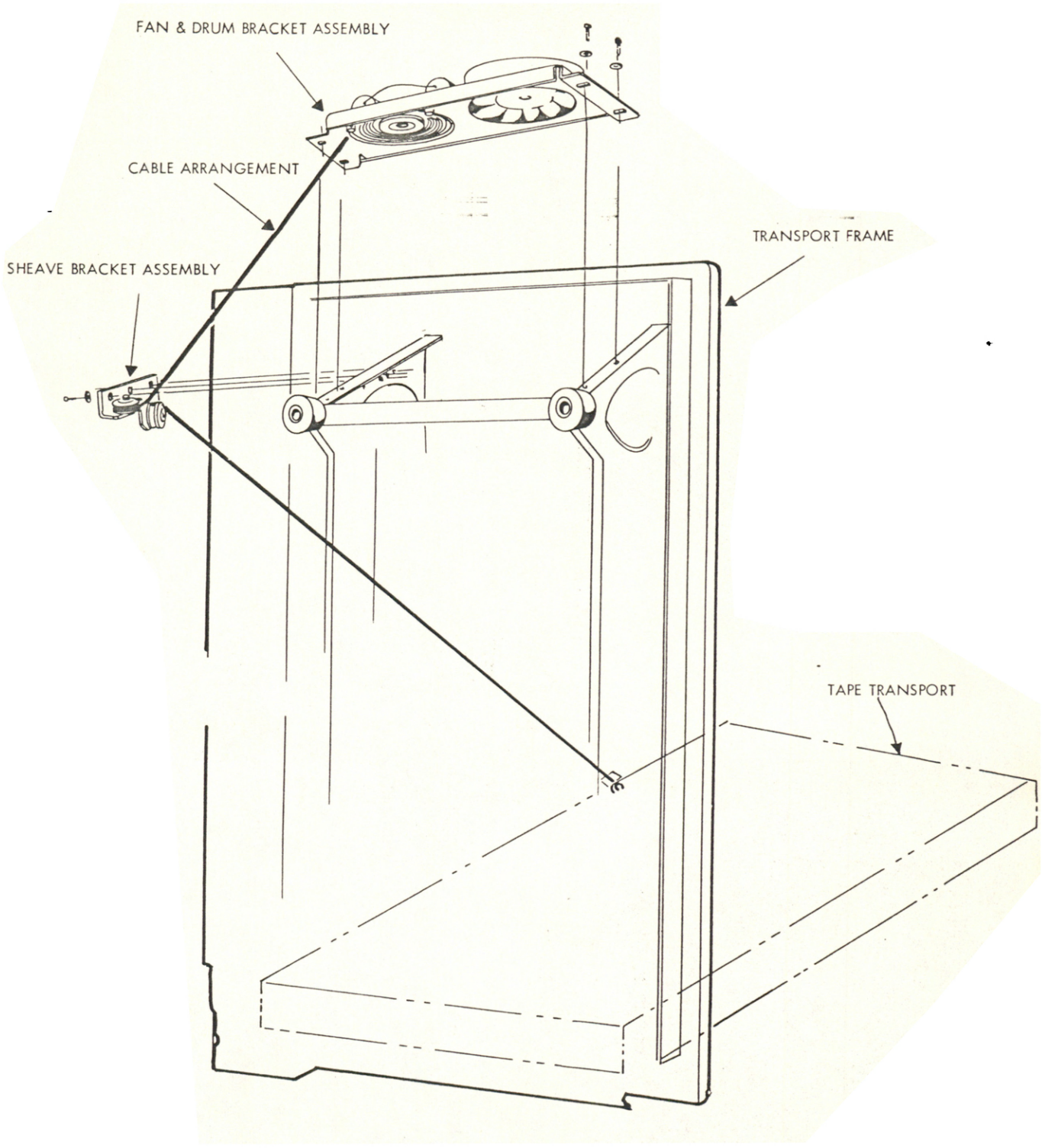


Figure 2. INSTALLATION OF RACK MOUNT ADAPTOR

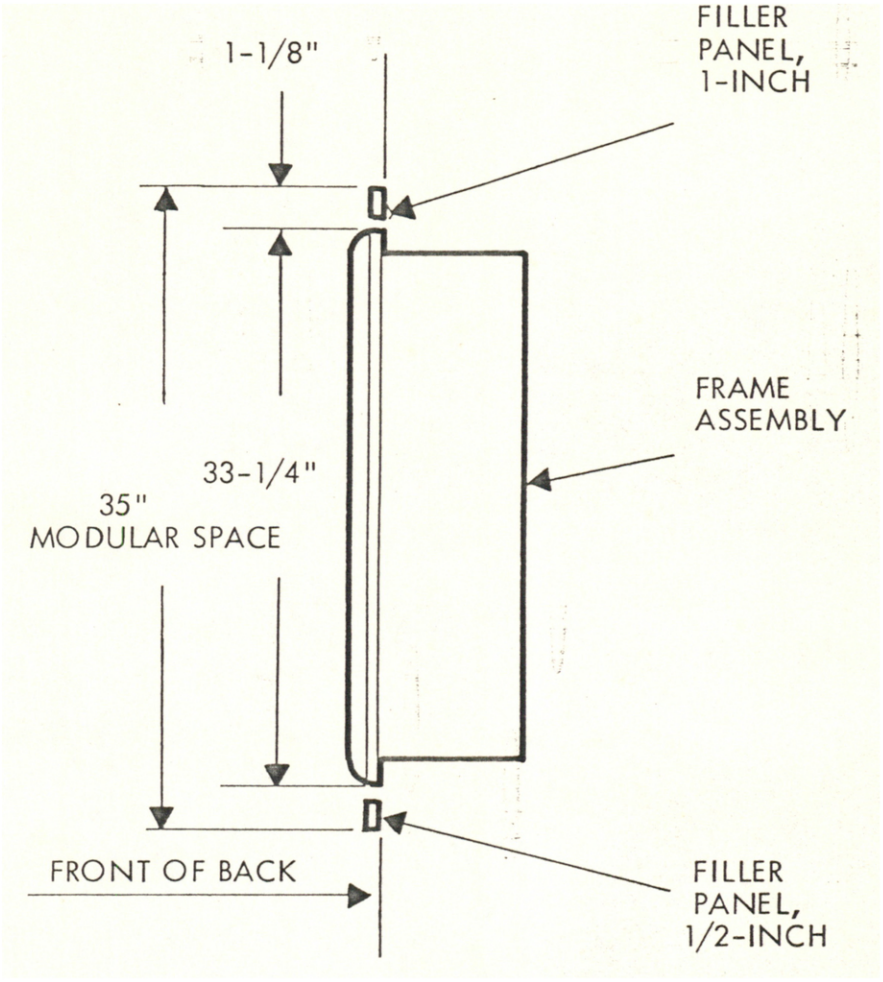


Figure 3. SIDE VIEW OF CP-100 READY FOR INSTALLATION IN RACK

PARTS LIST FOR: CP-100 RACK MOUNT INSTALLATION KIT
Ampex Catalog Number 126021-02

REF. NO.	AMPEX PART NO.	DESCRIPTION			NO/ ASSY.
1	126429-010	SHEAVE Assembly			1
2	49431-01	PANEL, Filler, 1/2 inch wide			1
3	49431-02	PANEL, Filler, 1 inch wide			1
4	470-041	SCREW, Cap hex socket head, 10-32 NF-2A x 7/8 lg., stl. cad plt.		MS35458-14	2
5	470-040	SCREW, Cap socket head, 10-32 NF-2A x 3/4 lg., st., cad plt.		MS35458-13	6
6	493-008	NUT, Self-locking, 10-32 NF-2B, stl., cad plt.	ESNA type: NM-26		8
7	501-011	WASHER, Flat, #10, stl., cad plt.		MS15795-208	15
8	503-030	WASHER, Nylon, 1/4 ID x 1/2 OD x 1/32 thk.	POLYMER: W-14		2
9	1220071-10	DECAL, Part identification			1
10	126029-020	DRUM AND BRACKET Assembly			1

PARTS LIST FOR: FAN AND DRUM BRACKET MOUNTING ASSEMBLY
Ampex Catalog Number 126029-02

REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
1	126020-010	BRACKET, Mounting for fan and drum	1
2.	125280-010	CAPACITOR, Fixed, metalized mylar, 6.0 uf, ±10%, 230 volts	1
3.	126432-020	DRUM AND BUSHING assembly	1
4	125800-010	HOLDER for spring	2
5	61768-1	CABLE, Electrical	A/R
6	49803-1	CAPACITOR, Fixed, metalized mylar, 6.0 uf, ±10%, 300 vdc	1
7	49802-1	CAPACITOR, Fixed, metalized mylar, 4.0 uf, ±10%; 400 vdc.	1
8	591-040	FAN, Blower, axial, 4.449 x 4.449 x 1.969; die cast; 117 vac, 60 cycle — PAMOTOR: Model 1000-60	1
9	302-058	CLAMP, Cable, plastic, for 1/8" cable, 1/8" ID — COMMERCIAL PLASTICS: 742.2	1
10	145-062	CONNECTOR, Plug, male, 4 contacts — WINCHESTER: M4PLSM10C	1
11	471-080	SCREW, Machine, pan hd. Phil. dr., 8.32 NC-2A x 1/2 lg., stl. cad plt. — MS35208-42	2
12	471-470	SCREW, Machine, pan hd., Phil. dr., 6-32 NC-2A x 1-1/2 lg. stl., cad plt. — MS35208-33	3
13	474-071	SCREW, Shoulder, 0.250 dia. x 1 lg., 10-24 UNC-3A, socket hd., stl., cad plt. — STANDARD PRESSED STEEL: 12705-4C-16	1
14	477-015	SCREW, Set, 8-32 UNC-3A x 1/4 lg., stl. cad plt., headless, hex socket — MS51034-29	2
15	470-192	SCREW, Cap, hex socket, 3/8-24 UNF-2A x 3 lg., stl. cad plt.	1
16	492-009	NUT, Hex, 6-32 NC-2B x 7/64 thk. x 5/16 flats, stl., cad plt. pln. type, std. — MS35649-62	6
17	493-006	NUT, Self-locking, hex, nylon insert, type II, class 3, 6-32 NC-3B x 0.178 ht. x 5/16 flats, stl. cad plt. — ESNA type: NM-26	4
18	492-043	NUT, Hex, 10-24 NC-2B x 1/8 thk. x 3/8 flats, stl. cad plt., pln type std. (per ASA)	1
19	493-010	NUT, Self-locking, hex, nylon insert, 3/8-24 NF-3A x 0.453 ht. x 0.563 flats, stl. cad plt. — ESNA type: NE	1
20	501-009	WASHER, Flat, rd. stl. cad plt., 0.156 dia., #6 screw size, 0.375 OD x 0.065 to 0.036 thk. — MS15795-206	5
21	501-010	WASHER, Flt., rd., stl. cad plt., 0.187 dia. #8 screw size, 0.375 OD x 0.065 to 0.036 thk. — MS15795-207	2
22	501-113	WASHER, Flt., stl. cad plt., 0.437 ID x 1.0 OD x 0.0625 thk. (per ASA)	1
23	502-004	WASHER, Lock, spring type, #8, stl. cad plt., 0.178/0.168 ID x 0.296 OD x 0.066/0.040 thk. — MS35338-42	2
24	502-003	WASHER, Lock, spring type, #6, stl. cad. plt. 0.151/0141 ID x 0.253 OD x 0.037/0.031 thk. — MS35338-41	4
25	502-043	WASHER, Lock, spring type, stl. cad plt., 3/8 — MS35338-46	1
26	492-011	NUT, Hex, 10-32 NF-2B x 1/8 thk. x 3/8 flats, stl. cad plt., pln. type, std. — MS35650-102	2
27	502-005	WASHER, Lock, spring type, #10 stl. cad plt., 0.205/0.194 ID x 0.337 OD x 0.053/0.047 thk. — MS35338-43	3
28	125227-020	CABLE, Support	1
29	477-119	SCREW, Set, 10-32 NF-2A x 1/4 lg., stl. cad plt., nylon insert — NYLOK: 10-32 x 1/4	2
30	471-618	SCREW, Machine, 6-32 NC-2A x 1-3/4 lg., rd. hd., stl. cad plt. (per ASA)	1
31	125226-020	SPRING, Assembly	1

PARTS LIST FOR: SHEAVE ASSEMBLY
Ampex Catalog Number 126429-01

REF. NO.	AMPEX PART NO.	DESCRIPTION	NO/ ASSY.
1	126022-010	PLATE, Sheave Mounting	1
2	027-002	SHEAVE, #2000 BOSTON GEAR or Equiv.	2
3	470-032	SCREW, Cap sock. hd. #8-32 NC-2A x 7/8 lg., stl. cad plt.	2
4	493-007	NUT, Selflocking #8-32 NC-2B	2
5	501-010	WASHER, Flat, #8 stl. cad plt.	2